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The UNITED STATES DEPARTMENT of AGRICULTURE

Its Growth, Structure and Functions

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DEPARTMENT OF AGRICULTURE
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The UNITED STATES DEPARTMENT of AGRICULTURE

Its Growth, Structure and Functions

BY

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Office of Information

WITH THE ASSISTANCE OF OFFICIALS
IN ALL THE BUREAUS AND OFFICES
OF THE DEPARTMENT

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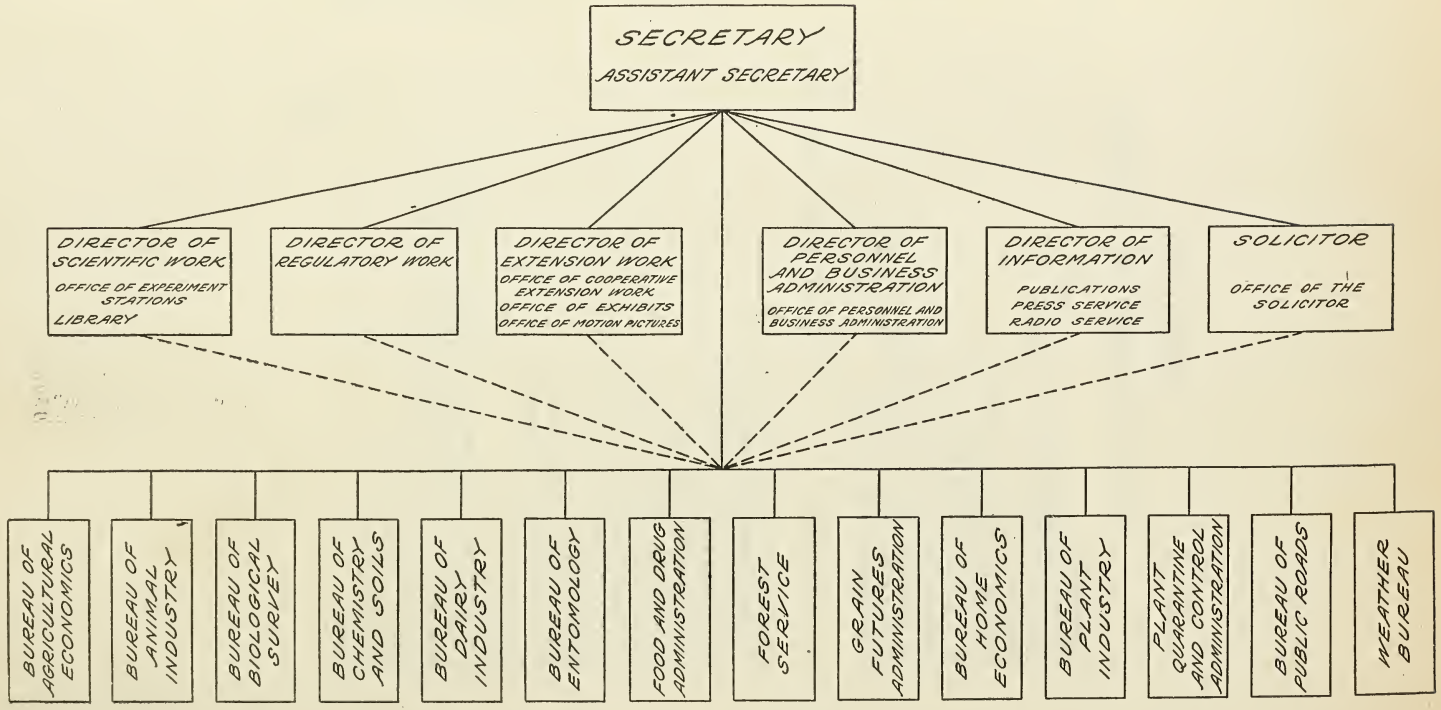
ORGANIZATION OF THE UNITED STATES DEPARTMENT OF AGRICULTURE



THE DEPARTMENT AS A WHOLE

INTRODUCTION

Every year adds new chapters to the story of the United States Department of Agriculture. Change and development in the department are more rapid to-day than ever before. This compilation is intended to answer questions that pour into the department ceaselessly, and to sketch in broad outlines the growth, structure, and present functions of the organization. Though nearly everyone knows that the department exists primarily to advance the welfare of agriculture in all ways consistent with the welfare of the community as a whole, few appreciate the variety of the tasks that this duty imposes. Nor does the public generally realize the character and value of the practical help it may obtain from the department for the asking. This lack of knowledge about the department lessens the potential usefulness of the institution and sometimes deprives the department of needed outside cooperation.

In the first half century of our national life the Federal Government gave little practical aid to agriculture. John Adams as early as 1776 introduced in the Continental Congress two resolutions relating to agriculture. The first proposed the encouragement of the production of certain agricultural commodities, and the second recommended that the Colonies take early measures for erecting and establishing in every Colony a society for the improvement of agriculture. George Washington proposed Government aid to agriculture in his first annual message to Congress; but at that time he simply suggested that it should be encouraged in a general way along with commerce and manufactures. He had progressed far beyond that point by 1796, when, in his last annual message to Congress, he remarked that as nations advance in population the cultivation of the soil becomes more and more an object of public patronage. "Institutions for promoting it [agriculture] grow up, supported by the public purse; and to what object can it be dedicated with greater propriety?"

Nothing came of these proposals. Twenty years passed before any further definite recommendations were made for Federal assistance to agriculture. Then in 1817 the Berkshire (Mass.) Association for the Promotion of Agriculture and Manufacturing petitioned for a national board to help agriculture and manufacturing. This proposal likewise came to nothing.

During the next 20 years the activity of Congress with regard to agriculture was practically limited to the appointment of an agricultural committee in the House in 1820 and the appointment of

a similar committee in the Senate in 1825. Not until 1839 were Federal funds specifically appropriated for agricultural services. That year, however, was epochal, for it saw the appropriation by Congress of $1,000 for collecting and distributing seeds, prosecuting agricultural investigations, and procuring agricultural statistics. From this small beginning developed a great national institution for agricultural research and service.

WORK STARTED IN PATENT OFFICE

Originally the Federal Government's agricultural services were carried on under the Commissioner of Patents, then an official of the Department of State. In colonial times, Benjamin Franklin, when he was in England as agent of the Colony of Pennsylvania, sent home silkworm eggs and mulberry cuttings to start silk growing, and also specimens of seeds and plants that he thought might be adapted to this country. This seems to have been a precedent for American consuls abroad, who, after the Revolution, followed his example, at first sporadically and later as a regular duty. Jefferson, as the first Secretary of State, took great interest in the introduction of plants and animals. Henry L. Ellsworth, Commissioner of Patents, undertook to distribute the specimens sent here by our agents. It was on Commissioner Ellsworth's recommendation that Congress made the $1,000 appropriation just mentioned. Succeeding commissioners continued the work. In 1849 the Patent Office was merged with the Department of the Interior, which had been set up in that year. Federal aid to agriculture was administered through the Patent Office from 1839 to 1862, when Congress took a great step forward by creating the Department of Agriculture, and by passing the Morrill Act, granting lands for the endowment of State agricultural colleges. It is significant of the growing interest in agriculture as a matter of national concern that these epoch-making steps were taken during the Civil War. The appropriations for agriculture were increased during the Civil War and grew rapidly thereafter.

LINCOLN SIGNED ACT IN 1862

The act creating the department was signed by President Lincoln on May 15, 1862, and in that year $64,000 was appropriated for agricultural purposes.

From 1862 until February, 1889, the department was administered, not by a Secretary of Cabinet rank, but by a Commissioner of Agriculture. In 1889, however, agriculture was given the recognition of a seat in the President's Cabinet. Norman J. Colman, previously commissioner, became the first Secretary of Agriculture. Succeeding Secretaries were: Jeremiah M. Rusk (1889–1893), J. Sterling Morton (1893–1897), James Wilson (1897–1913), David F.

Houston (1913–1919), E. T. Meredith (1919–1921), Henry C. Wallace (1921–1924), Howard M. Gore (1924–1925), W. M. Jardine (1925–1929), Arthur M. Hyde (1929–).

SCOPE OF THE ORGANIC ACT

The act creating the Department of Agriculture directed it to acquire and diffuse useful information on subjects connected with agriculture in the most general and comprehensive sense. Cooperation between the department and the land-grant colleges was provided for in the Morrill Act, passed at the same time. In 1887 came the Hatch Act, establishing agricultural experiment stations. The development of these stations necessitated the creation of an Office of Experiment Stations in the Department of Agriculture to supervise the expenditure of the Federal appropriations for experiment station work.

From 1890 on, the department's duties and responsibilities increased rapidly. Existing units of the organization were merged and new units created to carry on research, service activities, and regulatory-law administration. Cooperative extension work in agriculture and home economics was provided by the Smith-Lever Act of May 8, 1914, under which a nation-wide extension service was set up. Subsequent legislation provided increased extension funds. In 1889 the Federal appropriation for agriculture totaled nearly $2,000,000. By 1917 the figure had risen to approximately $30,000,000 annually. In the fiscal year ended June 30, 1929, money expended or obligated for department activities, including road building, exceeded $170,000,000.

In the Patent Office period, the agricultural work sponsored by the Federal Government was done by a commissioner and a few aids. To-day the department's personnel numbers approximately 25,000, of whom about 5,000 are in Washington and 20,000 in the field. In 1868 one building, erected at a cost of $100,000, housed the department's entire force of 73 persons. Its Washington staff now occupies more than 40 buildings or parts of buildings scattered over the city. Its field staff reaches into all the States, and into Alaska, Hawaii, Guam, Porto Rico, and the Virgin Islands. Representatives of the department are stationed in Europe, South America, and Asia.

THE PRESENT STRUCTURE

The United States Department of Agriculture is one of the 10 major executive departments of the Federal Government. Its affairs as a whole are supervised and controlled by the Secretary of Agriculture. He formulates and establishes its general policies. His extradepartmental functions include contacts with Congress, to secure necessary appropriations and to advise regarding pending agricultural legislation; contacts with other executive departments, to coordinate interdepartmental activities and to avoid duplication

in work; and membership on numerous boards and commissions, such as the Federal Farm Board, the Federal Board for Vocational Education, the Forest Reservation Commission, and the Migratory Bird Conservation Commission.

In his task of supervising the work of the department, the Secretary is assisted by a general administrative staff, including an Assistant Secretary, five directors of principal types of work, and a solicitor. The Assistant Secretary aids in the general supervision of the department and acts for the Secretary in his absence. In the absence of both the Secretary and Assistant Secretary, the Chief of the Weather Bureau becomes the Acting Secretary of Agriculture.

FUNCTIONS OF THE DIRECTORS

Each of the five directors supervises the work of the department pertaining to his special sphere, and reports directly to the Secretary. There are the Director of Scientific Work, the Director of Regulatory Work, the Director of Extension Work, the Director of Personnel and Business Administration, and the Director of Information. In many cases the responsibilities of the directors are connected with many of the department's bureaus and sometimes with them all. Their function, consequently, consists largely in coordinating the various activities so as to avoid duplications, to save time and money, and to forward a sound agricultural program. In addition to this general function, each of the directors has an organization under his immediate control. Thus the Chief of the Office of Experiment Stations reports to the Director of Scientific Work. The Director of Regulatory Work is also chief of the Food and Drug Administration. The Director of Extension Work has under him the Office of Cooperative Extension Work, the Office of Motion Pictures, and the Office of Exhibits. The Director of Personnel and Business Administration is in charge of the offices dealing with finance, personnel, salary classification, department organization, and general business operations. The Director of Information has immediate charge of the Office of Information, comprising the Division of Publications, the Press Service, and the Radio Service. The Solicitor, who is legal adviser to the Secretary, has a large staff of assistants.

MAJOR DEPARTMENTAL UNITS

The other major departmental units, each supervised by a chief who reports directly to the Secretary, are: Bureau of Agricultural Economics, Bureau of Animal Industry, Bureau of Biological Survey, Bureau of Chemistry and Soils, Bureau of Dairy Industry, Bureau of Entomology, Forest Service, Grain Futures Administration, Bureau of Home Economics, Bureau of Plant Industry, Plant Quarantine and Control Administration, Bureau of Public Roads, and Weather Bureau. These bureaus are subdivided into units for convenience in dealing with specialized work. All the bureaus and offices are served by a central library.

The work of the department is coordinated with the activities of the State colleges and experiment stations. In some cases this cooperation is made binding by formal agreement or by the control of funds, while in other cases the cooperation is voluntary. Thus the Secretary of Agriculture and the executive committee of the Association of Land-Grant Colleges appoint a joint committee to work with the Director of Scientific Work and the Office of Experiment Stations to correlate the scientific research of the Federal department and the State research agencies. In regulatory law administration it is often necessary for the department to establish contacts with State agencies, and this is done under the supervision of the Director of Regulatory Work. Extension activities of the Federal and State organizations are correlated by the Director of Extension. By voluntary action, those in charge of publication, press, and radio relationships of the colleges and the Director of Information of the department try to avoid duplications of endeavor and jointly plan special programs.

In general, the United States Department of Agriculture centers effort on national problems, interstate problems, or problems the solution of which may require facilities not possessed by the States. The State colleges, experiment stations, and State departments of agriculture deal with the more localized problems.

UNITY OF THE DEPARTMENT'S ACTIVITIES

A full description of so large and complex an organization as the United States Department of Agriculture would involve much discussion of American agriculture, for the department is intimately linked with our farming system. It is a service institution for the entire Nation, with many duties affecting nonagricultural interests. This recital is necessarily confined to the more outstanding features of the department.

The original task of collecting and issuing agricultural information, done mostly from a single office, has broadened until to-day the entire continental United States, the insular possessions, and many foreign countries serve as the department's laboratory. The collection of facts has developed into technical and scientific research in the biology of plants and animals. The dissemination of information now necessitates the printing of 30,000,000 copies of publications annually. It requires the work of a press service, a vast extension service, an office of exhibits, an office of motion pictures, and a radio service. The department's work in plant breeding, in introducing valuable plants from abroad, in excluding or eradicating plant and animal pests, in disseminating vital weather information, in economic investigations, in livestock improvement, in forestry, in the prevention of soil erosion, in soil classification, and in many other fields develops new knowledge faster than it can be published. To the original program have been added such

duties as the issuing of weather forecasts and warnings, the building of roads, the enforcement of numerous regulatory laws, and the grading and standardization of commodities.

SIX GENERAL CLASSES OF WORK

All the department's activities may be divided roughly into six general classes: (1) Research; (2) extension and information; (3) eradication or control of plant and animal diseases and pests; (4) service activities, such as weather and crop reporting, and forest and wild life refuge administration; (5) the administration of regulatory laws; and (6) road construction. These functions are closely interrelated and interdependent. Research, for example, is not complete in itself. Knowledge gained must be communicated to the public, used in eradicating plant and animal pests, and incorporated in regulatory-law administration. It is as essential a duty of the department to promote the application of science as it is to increase scientific knowledge. These manifold duties, though not the result of a preconceived plan, did not come about fortuitously. They developed from small beginnings in directions determined by agricultural and national wants and by the growth of science. The department is not a mechanical creation but a living institution evolving structurally and functionally in a changing world.

While the Department of Agriculture is called the farmer's branch of the Government, actually it is much more. Benefits arising out of the department's expenditures go to the entire public. Much of its work promotes public health and well-being. Its research, by helping farmers to grow better crops and livestock, to reduce their costs, and to market their products more efficiently, benefits the consumer as well as the producer. A few examples will show why practically everyone is interested in the department's activities.

The public has a vital interest in the Federal meat-inspection service, which costs more than $5,000,000 annually. This service maintains a high standard of sanitation in packing plants, and aims to insure safe animal products. The research and the veterinary work of the department promote public health by eradicating animal diseases or reducing their prevalence. The public is interested in the efficient and impartial enforcement of various regulatory laws. Through enforcement of the food and drugs act, the tea import act, the caustic poison act, the import milk act, and similar laws, the public is protected against unwholesome or adulterated foods and drugs, inferior disinfectants, and ineffective insecticides.

The weather service is indispensable to innumerable commercial and industrial enterprises, as well as to agriculture. Building contractors save on cement jobs by heeding frost forecasts. Shippers of perishable products prevent losses in the same way. Flood and storm warnings often have extreme commercial importance. Weather reports are indispensable for navigation and aviation.

Forest conservation and wild-life protection are of interest and value to the entire population. The department administers national forests with a total area of approximately 160,000,000 acres, including about 20 per cent of the forested land of the country. It cooperates with the States in protecting from fire some 240,000,000 acres of privately owned and State owned forest lands; it also cooperates in tree planting and in the management of farm wood lots; and it engages extensively in forest research. These activities are of immense value to the public as measures for the perpetuation of the country's forest resources.

The Bureau of Home Economics does work of general benefit by selecting well-balanced diets, determining ways of utilizing new foods, and finding new uses for textiles. Economic information about agriculture is needed by business men and farmers alike. Plant importations, pest eradication or control, studies in the life histories and habits of insects, wild-life conservation—these and many other phases of the department's work have widespread interest and value.

The largest single item of the department's expenditures is for the improvement of roads. In the fiscal year 1929, 56 per cent of the total expenditure was devoted to this purpose. Under this act the department cooperates with the highway department of each of the States in the construction of roads included in the Federal-aid highway system, and the Federal expenditures are matched by at least an equal expenditure by the States for this purpose. The Federal-aid system consists of the most important interstate and intercounty roads. Its improvement benefits city dwellers as much as farmers.

RESEARCH

Research, of course, is fundamental in the department's work. All interests to-day recognize that the Federal Government should promote agricultural science. It is a public, rather than a private, function because agricultural research does not ordinarily attract private enterprise. Individuals and corporations seldom have the public spirit, the scientific interest, or the financial resources to conduct agricultural research efficiently. There are exceptions. Sir John Lawes developed important new knowledge about fertilizers and soil treatment at a private experiment farm at Rothamsted, England, without government support or encouragement. But the expense and uncertainty involved in agricultural research are greater than private enterprise can usually stand. Not to carry it on, however, would mean neglecting one of the greatest sources of national wealth.

In the United States the first steps in agricultural research were begun by some of the State universities and by some of the endowed colleges in the universities. Since the middle of the nineteenth century the Federal Government has been its chief sup-

porter. Research now dominates all the work of the department, its service, regulatory, and educational activities as well as its scientific projects. Useful service must be grounded in scientific knowledge. Science furnishes the basis for the practical help the department gives farmers, home makers, handlers and processors of farm products, marketing agencies, manufacturers, business men, and consumers.

We may distinguish between research for more or less well-defined practical objects, and fundamental research for the discovery of basic facts and principles. The first type may be undertaken to throw up a hurried defense against diseases and pests, to develop plant varieties or strains of livestock suited to particular conditions, or to find new uses for crop by-products. Fundamental research is not directed toward any clearly defined practical goal. It explores physical or biological phenomena, primarily to increase the sum of knowledge rather than to attain any specified tangible advantage. This does not mean that fundamental research is not practical. It is practical in the highest and most permanent sense. Time and again fundamental research has developed facts or principles of revolutionary practical importance.

Both types of research are carried on in the department. Naturally research for specified objects bulks larger than fundamental research in the scientific program, because research funds are usually appropriated for specific purposes. Yet much fundamental research is done, because it is often impossible to solve problems by short-cut methods. Fundamental studies to unravel nature's secrets sometimes prove more practical than work less broadly conceived.

UNEXPECTED RESULTS OFTEN IMPORTANT

In practice the line between these two types of scientific activity is not always clear. Work started for a particular practical purpose may fail until its scope has been widened to include a study of the basic elements involved. Often the by-products of research outshine its contemplated results. The final test of science is practice, but it is not well to demand the test too soon. Years may pass between the discovery of a truth and its application. Scientific inquiry is essentially a long-time activity that can be truly appraised only on a long-time basis. A research policy that considered only immediate objects, and lost sight of the fact that much important knowledge is not recognized as such at first, would be shortsighted. Research probes into the unknown. By its nature it can not be restricted to foreseeable objects.

Departmental research in the phenomena of roundworm infestation of swine led to the development of a swine-sanitation system that saves the Corn Belt farmers who follow it probably a million dollars a year. The control of hog cholera followed the discovery that the disease is caused by a filterable virus. Fundamental research into the mosaic diseases had far-reaching practical signifi-

cance. The department demonstrated that the flowering and the vegetative growth of plants are controlled by alternations of light and darkness, and that the time of flowering can be controlled by changing the length of periods of exposure. This discovery opened great possibilities in the control of plant life. Many other examples might be given to show how fundamental research in the department has yielded practical results. Increasing importance attaches to research that discloses its ultimate value only when pooled in the common fund of scientific knowledge.

Specialized research is done in nearly all the department's bureaus, and touches every phase of agriculture as well as many related problems. This work deals with the selection and breeding of superior plants, the development of new varieties, and the biology of plant diseases. It studies how to increase the weight of the beef animal, and the milk production of the dairy cow. It ascertains facts about the nutritive value of feeds. It investigates problems of soil composition and fertilizer requirements. It develops poisons, insecticides, and serums for use in the war against pests and parasites. It goes into the economic problems of the farmer, into his social and community problems, into his transportation problems, into his problems as a consumer. It studies wild life, so that beneficial species may be protected and conserved or reared under domestication, and harmful species controlled. It deals with engineering problems, such as those connected with irrigation, with the prevention of soil erosion, with highway construction, and with the efficient use of farm machinery.

It embraces also problems of importance to the home maker, such as those connected with diet, cooking, clothing, house equipment, and the expenditure of the family income. It carries on work in industrial chemistry, to promote an increased utilization of farm products and farm by-products. It inquires into the purity and healthfulness of food and drugs offered for sale in interstate commerce. It studies the weather, for the protection of a thousand agricultural and industrial interests. All the main branches of science, particularly chemistry, biology, and physics, are represented in the department's research activities, which will be described in more detail in sections to follow on the various department bureaus and offices.

PUTTING SCIENCE INTO PRACTICE

Service functions grow out of the department's research. Knowledge gained by the study of animal diseases and parasites is the basis of control measures. Diagnosis of foot-and-mouth disease on its rare appearances in this country has led to its prompt and complete eradication. The same is true of the infectious poultry malady, European fowl pest, which appeared in the United States in 1924 and was eradicated in 1925. It made a second appearance in June, 1929, but prompt diagnosis led to its speedy suppression.

Research helps to eradicate or prevent bovine tuberculosis, tick fever, hog cholera, sheep and cattle scabies, diseases of animals on fur farms, and various other maladies. The department recently proved that anaplasmosis, a disease of cattle, exists in this country, and the knowledge led to experimental methods of control and treatment. A study of the so-called mosaic diseases of tobacco, tomatoes, cucumbers, potatoes, sugar beets, corn, wheat, sugarcane, and many other cultivated crops, including fruits, resulted in the development of resistant varieties and the establishment of these varieties in threatened areas.

ACCOMPLISHMENTS OF ENTOMOLOGY

The cotton-boll weevil, one of the worst insect pests, has been brought under a large degree of control by thorough dusting of the cotton plants at appropriate times with powdered calcium arsenate. The discovery of the susceptibility of the insect to certain arsenical poisons gave cotton growers a means of decreasing its injury to the cotton crop even during the worst boll-weevil years. The result is a net benefit, averaging $15 an acre.

Curly top, a serious malady of the sugar beet, is attributed to a small leaf hopper. This pest normally migrates from the desert into beet fields, carrying with it a virus which produces the malady of sugar beets. An entomologist trained also in ecology discovered the influences which result in the migration of the insect and the conditions under which migration is likely to take place. Hence the department can inform growers, in time for the information to have a bearing on their sugar-beet planting, whether an abundant or a light infestation of the pest that causes curly top is likely to occur during the coming season.

CORRELATING DISEASE KNOWLEDGE

Toward the end of the nineteenth century the fundamental discovery was made that plants, like animals, are subject to disease. Formerly the fungi that cause plant diseases were considered merely as interesting plant organisms without reference to their economic importance or to their control. Pear blight was the first bacterial disease of plants to be so recognized. Why the disease often developed almost at once on the whole bloom of the tree, however, was still a mystery. One morning, in the department's grounds at Washington, a member of the department saw a bee dive into a pear blossom. He caught the insect, removed certain adhering substances from its head and body, and looked at these substances through a microscope. He found the pear-blight organism. Thus was established the important fact that plant disease can be carried from one plant to another, and the simultaneous development of pear blight on many blossoms was explained.

This discovery was followed two years later by the discovery that splenetic or tick fever is transmitted by the cattle tick. The joint

responsibility of bacteria and parasites in the causation of plant and animal diseases was revealed and a basis laid for effective disease-control work. Through quarantine action in the Southern States cattle ticks were eradicated from large areas and cattle freed from a disease that had formerly caused heavy losses. Out of 985 counties that were quarantined when systematic tick eradication began in 1906, only 177 still had to be kept in quarantine at the end of 1929. This is one of the most outstanding successes of regulatory action based on scientific discovery in the department.

Benefits derived from the revelation that plant diseases may be transmitted by insects and other invertebrates have not been confined to agriculture. In the tick-fever investigation it was demonstrated that the actual cause of the disease is a microorganism found in the blood of infected cattle, and that the cattle tick is the only means whereby the disease can be transmitted. This proof that a protozoan disease may be transmitted exclusively by an intermediate host or carrier led to the knowledge that yellow fever, malaria, typhus fever, African sleeping sickness, Rocky Mountain fever, nagana, and other diseases are similarly communicated. It made possible the control of yellow fever in the Panama Canal Zone. Many plant diseases, including sugarcane mosaic and sugar-beet curly top, are transmitted by insects.

TRIUMPHS IN PLANT BREEDING

Another branch of study in the department that has had important practical consequences, including the enactment and enforcement of certain regulatory laws, is plant breeding. In the strict sense plant breeding is a comparatively new development, though plant improvement has been going on since man first became interested in plants. Methodical plant breeding was unknown before the discovery that plants are male and female.

This fact, though previously suspected, was not definitely established until less than two centuries ago. The greatest progress in plant breeding is a development of the last 20 or 30 years. Plant breeding in the Department of Agriculture has developed plant varieties that thrive where the varieties previously known could not, and has improved the quality, the yield, the disease resistance, and the climatic adaptability of many crops.

Among early triumphs in this field was the discovery of important facts about cotton wilt and about the nematode diseases of cowpeas and other leguminous crops. Through plant breeding the potato industry has been protected and the sugar industry of Porto Rico and Louisiana reestablished. Plant breeding has pushed up the northern boundary of spring wheat and promises to do the same for winter wheat. The discovery that resistance to disease and to climatic conditions is a genetic character which may be bred into or bred out of plants constitutes the justification for such legislation

as the Federal seed act. This law requires that all seed of alfalfa and red clover imported into the United States shall be artificially colored, so that the purchaser may know whether he is buying seed of domestic or foreign production.

PLANT IMPORTATIONS

Research and service activities are combined in the introduction of foreign plants, which has been a major function of the department ever since it was created. As already noted, plant introduction long antedates the creation of the department. It was practiced by the early settlers, and was promoted after 1839 through the Patent Office. All our field crops, except tobacco and corn and a few lesser crops, have been introduced from foreign countries. The original home of the potato is below our southern boundary. In the last 30 years or so plant-introduction work in the department has been systematized and scientifically controlled, and its value much increased. Citrus fruits, durum wheat, alfalfa and Sudan grass, Acala cotton, numerous important varieties of soybeans, Japanese plums, vinifera grapes, Persian walnuts, figs, and many other valuable crops have been introduced.

Highly trained plant explorers seek valuable new plants in all parts of the world. These plants, when received into the United States, are tested and cultivated to determine their importance to American agriculture. Entomologists and pathologists carefully inspect each shipment for pests and signs of disease. All imported seeds are fumigated regardless of their origin, and many bulbs are treated with hot water to kill nematodes. Specimens from countries where especially dangerous pests or diseases occur are given additional treatment. Quarantine houses are maintained where the imported plants may be grown under observation, to disclose any condition not apparent on their arrival. In short, botanical and pathological studies go hand in hand with the propagation and establishment of the new varieties. Some idea of the scope of the department's plant-introduction work is evident from the fact that the serial numbers given to the imported specimens now run above 90,000. The numbering system was started about 25 years ago.

NEW PROBLEMS FROM PLANT IMPORTATIONS

Plant-introduction work involves a combination of research and service in many ways besides the testing and establishing of plant immigrants. It raises new problems in human nutrition, in animal husbandry, in commodity standardization, inspection, and marketing, in soil treatment, in the distribution of types of farming, and in insect and disease control—in all of which matters the department is vitally concerned. Imported plants have furnished the basis for some of the most successful experiments in plant breeding by the

department and the State experiment stations. Thus, Kanred wheat, recognized as strictly an American variety, was derived by selection at one of the State stations from a strain imported by the department. The introduction of Sudan grass as a forage crop in our semiarid regions stimulated farming where formerly it had not thrived, and had consequences that touched practically all phases of the department's work.

COMBINING RESEARCH AND REGULATORY WORK

Research and regulatory work interact, as is shown, for example, by the course taken following the discovery that white-pine blister rust lives alternately on the white pine and on currant and gooseberry plants. This discovery led the department in 1917 to establish a quarantine line through the Mississippi Valley so as to prevent a further westward movement of dangerous host plants from the eastern white pine region. The measure was effective in checking the westward spread of the rust. In like manner the discovery by European investigators about 1865 that the common barberry is the alternate host of the black stem rust of cereals led to regulatory activities. In 1929 the department demonstrated that the baffling phony disease of peach trees, which is prevalent in Georgia and to a lesser extent in Alabama and Mississippi, and is increasing in severity, is a communicable root disease. This knowledge likewise became the basis of quarantine action.

LONG-DISTANCE SHIPMENT OF PERISHABLES

Long-distance shipments of fruits and vegetables, and extensive Federal services connected therewith, are an outgrowth of research done in the Department of Agriculture in cooperation with the State agricultural colleges and the experiment stations. Fifty years ago most of the commercial peach orchards, for example, were in a narrow fringe near the Middle Atlantic tidewater from Long Island Sound to Cape Charles, and in a similar narrow fringe on the south shore of Lakes Ontario and Erie and on the eastern shore of Lake Michigan. They were there because the peaches grew within a 24-hour ride of the ultimate consumer. Twenty-four hours was then about as long a life as the well-ripened peach had. About 1890, a refrigerator car suited to the transportation of fruits and vegetables was developed, and a refrigerator-car icing service was established on the sleeping and dining car plan. This new system, which soon covered the entire country, largely abolished distance as a limiting factor in the production of fruit and vegetables for domestic consumption and gave a nation-wide market to an industry formerly dependent on local distribution.

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THE ECONOMIC SERVICES

Farmers need economic information as well as help in combating insect and other pests and in improving their field crops and livestock. Lacking data on markets and prices, the farmer works in the dark, with small chance to make a profit. This fact, though generally recognized, was formerly not taken sufficiently into account in public services for agriculture. Research was largely concentrated on the technic of production. As production per acre and per man increased and the farm area expanded, surplus problems grew more pressing. Action became necessary to effect a better regulation of supply to demand, and a more orderly flow of production into consumption.

The first requirement was more information about production, stocks, and consumption demands. Progress in statistical science made it possible to satisfy this requirement. Accordingly, the department developed extensive and varied economic services, in which research was combined with the regular gathering of crop and market data, and with numerous related services, such as commodity grading and standardization, shipping and receiving point inspection of farm commodities, seed verification, price analysis, and "outlook" reporting. Farm-management studies were undertaken, whereby general economic information was related to the needs of particular localities and particular farms. In short, the department began systematically to help the farmer look ahead, and the work soon became a major departmental activity.

In its production studies the department brings science to the farmer's aid in learning how to grow his various crops. In its economic studies it tries to help him decide what to grow. It endeavors, in other words, to help him establish a good balance among his different crop enterprises and to adjust his production as a whole to market needs. This work is closely linked with the technology of production, because changes in acreage and in livestock breeding accomplish their desired end more surely when the plant varieties grown and the livestock raised are superior types that may normally be relied on for stable performance.

COOPERATION AMONG EXPERTS

Economists and production technicians work hand in hand in the department's economic services. In crop reporting the economists are aided by weather reports and by reports from the department's entomologists and plant pathologists so that damage from the weather and from pests and diseases may be more accurately estimated. In farm-management studies, cooperation is necessary among economists, chemists, biologists, animal-husbandry experts, entomologists, and plant-production specialists. Grading and standardization and commodity inspection depend largely on knowledge gained in production research. In the grading of fruits and vegetables, the

plant breeder and the plant pathologist assist by developing products adapted to specific requirements. In the grading of meat animals, the animal-husbandry expert tells how to recognize quality factors. Technical information is indispensable in the grading of grain and cotton. Practically all the department's bureaus and offices and all its different scientific services join in making its economic work practically useful. Regulatory policy, especially in connection with such laws as the packers and stockyards act, and the plant and animal quarantine acts, has important economic relationships.

SERVICE PRIMARILY FOR FARMERS

Economic information put out by the department is primarily for the farmer, though useful to all persons having dealings with agriculture. Reliable information about market prospects helps the farmer to adjust his acreage and his livestock breeding intelligently, and to join with other farmers in concerted action to stabilize production. It also lessens the influence of speculation in the agricultural commodity markets. Prices stick closer to the supply and demand line when the facts about supply and demand are accurately and generally known. There is then less room for the influence of uninformed opinion or deliberate misinformation. Ultimately, prices depend on tangible and measurable elements in the supply and demand equation. Among these elements production is the most important, and the measurement of production has attained a high degree of accuracy. Progress has been made also in the measurement of demand, which depends on such factors as the general price level, the state of business and employment, and the possibility of substituting one commodity for another in various uses. Light on these factors is a powerful influence in reducing price fluctuations. What bookkeeping is to the individual or to the business corporation, economic information is to agriculture as a whole.

Economic research deals also with such questions as the proper utilization of land, the balancing of the various crops of a farm so as to give the best net results, the proper size of farms, the tax problem, the tariff problem, the credit problem, the problem of family living standards, the influence of population movements on agriculture and on economic conditions generally, shifts in types of farming, conditions that justify specialization or diversification, and many other matters. Particularly important are the land-utilization studies, which indicate the best uses for different types of land and disclose the need or lack of need for expansion, drainage, reclamation, and so on.

REGULATORY-LAW ADMINISTRATION

The department administers approximately 50 regulatory statutes. The most important are the animal quarantine laws, the meat inspection act, the virus serum toxin act, the packers and stockyards act, the 28-hour law, the renovated butter act, the plant quarantine

act, the food and drugs act, the tea importation act, the import milk act, the naval stores act, the caustic poison act, the insecticide and fungicide act, the seed importation act, the migratory bird treaty act, the Lacey Act (affecting wild life), the Alaska game law, the cotton standards act, the grain standards act, the Federal warehouse act, the cotton futures act, and the grain futures act.

Like its other activities, the department's regulatory work was developed to meet long-standing public needs or new conditions created by the progress of scientific knowledge and the growth of population and markets. It originated with the creation of the Bureau of Animal Industry in 1884, when Congress passed certain legislation to regulate traffic in livestock. Contagious pleuropneumonia was then prevalent among livestock in several States east of the Mississippi River, and several European countries had refused to admit livestock from the United States except for immediate slaughter. Under congressional authority quarantine regulations were imposed and disease-control methods investigated. These measures finally gained the removal of the European restrictions.

THE PURPOSE OF REGULATORY WORK

As in the case of the animal quarantines, all the regulatory work of the department is designed to eliminate or prevent social hazards, waste of resources, and economic abuses. Ethical, sanitary, conservation, or economic reasons underlie all the regulatory statutes which the department administers. Thus the food and drugs act and the meat inspection act exist to insure to the public unadulterated foods and drugs and wholesome meats. The plant and animal quarantines are designed to prevent the introduction into this country, or the spread within it, of diseases and pests. The migratory-bird treaty act is administered to protect game birds and insectivorous birds.

Such laws, however, have a wider purpose than merely to protect the public against economic loss or harmful goods. This wider purpose includes the promotion of agriculture and social welfare by a raising of technical and commercial standards. Regulatory action that assures the public of high-quality goods benefits producer and consumer alike. It protects the reputable producer against fraudulent or unscrupulous competition and safeguards both the pocket and the health of the consumer.

In general the regulatory laws administered by the department affect the agricultural industry or industries utilizing agricultural products. That is the principal reason why the department has been chosen to enforce them.

GRAIN AND COTTON ACTS

The grain standards act and the cotton standards act are good examples of regulatory laws that result in benefits far exceeding the prevention of abuses. These statutes do, of course, contain penal

clauses for the prevention of improper trade practices. Probably more important, however, is their provision for fixed commodity standards, which encourage the production of improved commodities, and facilitate trade. The penal provisions of the grain standards act have no other purpose than to promote a uniform method of grading in the general interest. Prior to its passage there was a total lack of uniformity in grain standards throughout the country. Commercial grades were established either by commercial boards of trade or chambers of commerce, except in half a dozen States that had enacted laws providing for grades and grain inspection. Grade terms meant different things in different places. Buyers could have little confidence in grade certificates. When Federal standards were promulgated under the grain standards act, an immense improvement was brought about in grain-trading facilities. Similar advantages followed the enactment of the cotton standards act. Buyers and sellers found themselves speaking a common trade language and doing business more efficiently. Similarly, improved economic conditions resulted from the Federal warehouse act, which provides for the storage of crops in a manner that increases their value as loan collateral.

EXCLUSION OF PESTS

Perhaps the most convincing proof that regulatory laws are necessary is the entry of foreign plant pests. Until 1912 practically no control was exercised over their entry, and a stream of new enemies dangerous to our agricultural industry poured across our borders. Six new major pests got into the country in the four years immediately preceding 1912, when the plant quarantine act was passed. These were the oriental fruit worm, the Japanese beetle, the citrus canker, the potato wart, the camphor scale, and the European corn borer. Other pests that had previously entered included the Hessian fly, the cotton boll weevil, the alfalfa weevil, the brown-tail and gipsy moths, the chestnut blight, the white-pine blister rust, and the wheat smut. In 1929 the Mediterranean fruit fly, perhaps the worst fruit pest known, was found to have invaded Florida. In fact, 50 per cent or more of our existing plant pests and diseases are of foreign origin. Foreign-plant quarantines have been successful in completely excluding serious insect pests and plant diseases, the Mediterranean fruit fly being the only pest of first importance known to have reached this country from other continents since the passage of the plant quarantine act.

It should be pointed out that in 1900 Congress regulated the importation of wild animals and birds and prohibited the entry of such species as were injurious to agriculture. At that time only two birds, the English sparrow and the European starling, both injurious species, had become established in the United States. Since the enactment of this law, so far as known, no injurious species of mammal or bird has gained a foothold in this country.

EDUCATION TO SECURE LAW OBSERVANCE

Though most of the regulatory laws administered by the department contain clauses providing for the punishment of offenders, the department's enforcement policy emphasizes service rather than punishment. Observance of the laws is sought first by educational means, in a manner that emphasizes the common interest of producers and consumers in their impartial and effective application. Willful violations are rare, except in the case of game laws. For the most part the regulatory laws are administered with the hearty and intelligent cooperation of the commercial interests concerned. For example, the food and drugs act authorizes litigation against manufacturers and sellers of food and drug products who do not comply with the statute. Sometimes, of course, legal action is necessary. In most cases, however, the purpose of the law is fulfilled, not by a mechanical enforcement of its provisions, but by an educational and helpful policy which assists manufacturers and others to comply with its requirements.

In general, the department strives to enlist the cooperation of the commercial agencies concerned, so that voluntary action may be substituted for the compulsory correction of improper practices. Many violations of the food and drugs act result from lack of information about its requirements. An advisory rather than an arbitrary policy has been adopted to lessen the number of such violations. The result has abundantly justified this course.

Some of the regulatory laws give the department administrative discretion. Thus the packers and stockyards act imposes upon the Secretary of Agriculture quasi-judicial duties. It authorizes him to issue "cease and desist" orders and to make findings in rate matters. On the other hand, the caustic poison act gives no discretionary leeway. In all cases, however, the underlying principle is the same; namely, social and economic improvement. Adoption of an advisory rather than a bureaucratic attitude does not involve the department in any relaxation of standards or requirements. It absolves no one from his responsibilities, but merely gets the laws complied with more readily.

MEDITERRANEAN FRUIT-FLY QUARANTINE

Thus in 1929 the department undertook to assist the State of Florida in the eradication of the Mediterranean fruit fly and, by quarantine action, to prevent its spread during the progress of eradication operations. This quarantine restricted shipments of fruit out of the infested section and threatened many fruit growers with loss. It would have been sufficient, under the terms of the law, for the department to have enforced the shipping restrictions indiscriminately. Instead, specialists of the department developed two different treatments by which eggs and larvae of the fly can be killed in consignments of fruit offered for shipment. Under

one of these, refrigeration is employed; the other is a heat treatment. By these methods fruit is made safe for shipment without noticeably impairing its flavor or quality. All fruit moved from the State was inspected, and fruit known to be infested was destroyed. The methods of treatment provided a form of protection under which the Florida citrus crop as a whole was permitted to move to destination without serious inconvenience or expense and without risk of spreading the fruit fly. Thus by constructive helpful action the department facilitated full observance of the quarantine, while at the same time saving producers from heavy losses.

EDUCATIONAL FUNCTIONS

Results of the research and other work done in the department must be communicated to the public, or their value is largely lost. Research must have a mouthpiece. It can not be done well in closed compartments without facilities for communicating results to scientific workers everywhere and to farmers and the general public. Work done in the dark means duplication of effort and loss of the stimulus that discovery in one field should have on other investigations in other fields. Hence, the department maintains various informational services, which include a cooperative extension service, bulletins, motion pictures and exhibits, press and radio services, weather forecasts, crop and market reports and outlook reports, periodicals, soil surveys, and correspondence with individuals.

Through the Extension Service, results of research done in the department are correlated with research data obtained by the State experiment stations or State agricultural colleges. The combined material is carried by extension workers direct to farm men and women. By contacts with State and county organizations, the Extension Service maintains a network of communications covering the entire country.

GAP BETWEEN SCIENCE AND PRACTICE

When the Smith-Lever Act of May 8, 1914, was passed, setting up a nation-wide organization for better agricultural education, it was declared in Congress that the department and the State colleges and experiment stations had agricultural knowledge 25 years in advance of average farm practice. To-day the gap, though not closed, is narrower. Agricultural science is put into practice probably quicker and more generally in the United States than in any other country. This is unquestionably the result of efficient educational work. So satisfied was Congress with the results achieved under the Smith-Lever Act that in 1928 it passed the Capper-Ketcham Act increasing the Federal contribution for extension work by $980,000 in 1929, and by $1,480,000 in 1930 and annually thereafter.

Agricultural education in the United States started long before the passage of the Smith-Lever Act.[1] It was under way in the endowed colleges and State colleges early in the nineteenth century. It was tremendously strengthened by the land grant act of 1862, giving large tracts to the States for the endowment of agricultural colleges. Other Federal legislation appropriates money to each of the States annually for scientific research and for extension work. The United States Department of Agriculture supervises the administration of these funds, and thus exercises a far-reaching influence on agricultural education. Agriculture and home economics are now taught not only in grade schools and in high schools and colleges, but in vocational schools. In the colleges of agriculture special training is provided for persons who intend to become teachers, experimenters, county agents, or farmers.

Publications issued by the department are an important educational force. The department distributes free each year approximately 30,000,000 bulletins, circulars, periodicals, publication lists, and other publications. The department has made and distributed some 250 motion pictures on subjects of interest mainly to farmers. Probably 10,000,000 persons annually see one or more of the department's educational films. Exhibits are prepared for fairs and exhibitions. Much information gathered in the department finds an outlet through the press, and radio broadcasting has become important in the educational scheme.

COOPERATION WITH STATE AGENCIES

Much of the department's most important work is done in close cooperation with State agencies. Federal and State efforts in research and in educational extension are tied together under the laws making provision for these activities. The Hatch Act of 1887 providing for agricultural experiment stations at the land-grant colleges arranged also for their supervision. Accordingly, on October 1, 1888, the Secretary of Agriculture established the Office of Experiment Stations. This was a bureau of the department until 1915, when it became part of a newly created States Relations Service. It became a separate unit again on the abolition of the States Relations Service in 1923. In 1906 the Office of Experiment Stations was strengthened by the passage of the Adams Act, which provided " for an increased annual appropriation for agricultural experiment stations and regulating the expenditures thereof."

Additional funds for research in the experiment stations were made available under the Purnell Act of 1925. This measure authorized work at the experiment stations in agricultural economics, in rural sociology and in home economics, as well as in the technic of production. It called for supervision of the work by the Department

[1] A History of Agricultural Education in the United States, 1785–1925, by Alfred C. True, may be purchased from the Superintendent of Documents, Washington, D. C., for $1 a copy.

of Agriculture so as to avoid a duplication of projects and consequent waste of time and money. As a result, the research of this department was more closely coordinated with that of the experiment stations.

COOPERATIVE PRINCIPLE IN RESEARCH

The department and the stations are now cooperating in approximately 1,100 research projects, and in a large number of less formal ways. Approximately 12 per cent of the research of the experiment stations is done cooperatively with Federal research workers. Thus two great systems of agricultural investigation, functioning in close harmony, make a concerted attack on problems involving diverse conditions and requiring approach from many angles. Credit is shared by the department and the stations for some of the most important developments in agricultural science. Scientific progress is always a cooperative result in large measure. In this country the cooperative principle in research has been emphasized increasingly for many decades.

COOPERATION IN EXTENSION WORK

In agricultural extension all the department's work is done in cooperation with the State colleges of agriculture. Both the Smith-Lever Act of May 8, 1914, and the Capper-Ketcham Act of May 22, 1928, the first establishing and the second strengthening the extension system, contemplate a close relationship between Federal and State agencies. In the fiscal year ended June 30, 1929, the total funds available for cooperative extension work were approximately $22,918,200, an increase of about $2,000,000 over the amount available in the previous year. The Federal Government contributed 39 per cent of this sum and 28 per cent came from State appropriations to the agricultural colleges and other State agencies. The remainder came from county appropriations for extension work and from contributions by local organizations and individuals.

Not merely its large interest as a contributor of extension funds, but its recognition of the need for cooperation as an aid to economy in expenditure, give the Federal Government a strong motive for emphasizing the cooperative principle in educational extension. The department's field staff of extension workers join with State workers in applying general economic and scientific information to State and local conditions. In this way a better result is achieved than either the Federal or the State extension forces could achieve independently.

CONTRIBUTION OF NONAGRICULTURAL RESEARCH

Agricultural science is, of course, not an isolated subject, walled off from other branches of knowledge, but a part of science as a whole. Hence the department's research and extension program is helped by work done in fields apparently remote from agriculture,

as well as by the cooperative relationship that exists between the department and the agricultural colleges and experiment stations. What agricultural science in general and the department's scientific work in particular owe to nonagricultural investigations can not be measured.

Many examples of the cooperative nature of scientific progress could be cited. Specific discoveries depend for their full effect on varied applications, often in widely separated fields. Agriculture owes much to Federal support extended through the Department of Agriculture; it owes much to Federal and State aid given through State institutions. It is indebted also to scientific work wherever it is done, and whatever its character. Naturally it draws freely on the constantly increasing fund of scientific knowledge throughout the world.

COOPERATION WITH THE FEDERAL FARM BOARD

As required by the agricultural marketing act of 1929, the department extends full cooperation to the Federal Farm Board established under that legislation. The Secretary of Agriculture is a member of the board ex officio. Most of the department's bureaus, in varying degree, assist the board with research and service. The Federal Farm Board is not a division of the department or of any other governmental agency, but an independent unit.[2] Congress did not intend, however, that the board should duplicate the work of the Department of Agriculture, but simply that its work and that of the department should be effectively coordinated. The department, of course, cooperates with all other Federal agencies in matters affecting agriculture. It has frequent contacts with the Department of Commerce, the Department of State, the Department of the Interior, the Federal Reserve Board, the Federal Farm Loan Bureau, and other Federal institutions.

The main object of the agricultural marketing act is to help farmers organize effective marketing associations under their own control and to adjust production to avoid burdensome surpluses. In promoting this end, the Federal Farm Board is on the firing line while the department makes and supplies ammunition. In research, in service activities, and in the enforcement of regulatory laws, the department functions as it has done in the past. But it has not the legal authority nor is it the suitable agency to make practical application of all the results of its research.

Some idea of the many points at which the department's work touches that of the board can be gained from a glance at what Congress has called on the board to do. The board is directed to help in minimizing speculation, in lessening the wastes of distribution, in promoting the organization of producers into effective marketing

[2] Requests for information about cooperative marketing and other elements under the jurisdiction of the Federal Farm Board should be addressed to the Director of Information, Federal Farm Board, Washington, D. C.

associations, in preventing the production of burdensome surpluses, and in regulating the marketing of such surpluses as may be unavoidably produced. It is asked to assist in developing a national policy with reference to land utilization, marginal lands, and the control of the farm-land area, and to study transportation conditions and their effect on the marketing of farm products.

THE DEPARTMENT AND THE BOARD

In discharging this task the board's first requirement is adequate and reliable information. It is impossible, for example, to check harmful speculation without data regarding speculative operations in commodity markets. Such data are gathered regularly by the Grain Futures Administration of the Department of Agriculture. In efforts to lessen the wastes of distribution, facts must be available to show where such wastes occur and how they may be obviated. Such material is compiled by the department in consumer-demand studies and in surveys of retail and wholesale business methods. Similarly, basic information is needed on land utilization, credit, insurance, prices of farm products, and foreign competition and demand in foreign countries affecting American farm products. Research of this character is the special task of the department's economists and statisticians. Any land-utilization policies the board may develop will probably owe much to the department's land-utilization studies. In like manner, work done in the department on agricultural-freight rates and highway-transport conditions should prove useful to the board.

In formulating its marketing and price-stabilization policies, the board depends vitally on information furnished to it by the department's crop-reporting and market-news services. It looks to the department also for studies of market prospects, so that it may advise farmers whether to increase or decrease their output of different crops. In its financial policies the board has close relations with the department's division of agricultural finance and with the division charged with the administration of the Federal warehouse act. Farm financing is not merely a question of funds; it involves also such matters as crop risks, crop-storage facilities, and market prospects. Hence the board, besides availing itself of information already accumulated by the department on these subjects, calls upon it from time to time for special studies. It looks to the department for research material, marketing services, and economic counsel.

EXTENSION WORKERS AID BOARD'S PROGRAM

Federal extension workers, and also State extension forces and the land-grant colleges and universities, cooperate with the Federal Farm Board in assembling information as to the need for the cooperative organization of various groups of producers. They arrange meetings of farmers to discuss organization plans. They help

growers and others to get copies of legal documents and organization data useful in organizing cooperative associations. They assemble information as a basis for marketing programs, and indicate changes necessary to bring farmers' business organizations within the requirements of Federal laws. Since the board's program requires the intelligent cooperation of the farmers, the extension services have a vitally important duty in explaining the program to the farmers and in showing them how they may advance it.

To avoid duplication of existing machinery in carrying forward the educational program, coordinated effort is made by this department, by the agricultural colleges, including the one in the Hawaiian Islands, and by more than 5,700 extension agents. These forces seek to facilitate the board's policy (1) by doing research in marketing; (2) by training men in cooperative leadership; and (3) by assisting farmers in organizing new associations and in improving old ones. In this way a nation-wide educational movement helps to promote the underlying purpose of the agricultural marketing act.

Though the board's program in its initial stages emphasizes cooperative marketing and the better seasonal adjustment of crop planting and livestock breeding, it involves ultimately much more. Such problems as the geographic specialization of crops, the influence of machinery on the size of farms, and the relation between applied agricultural science and the volume of farm production, are of concern to the board. Hence many functions of the Department of Agriculture, which at first glance may appear connected with the board's work only very remotely, may eventually affect it closely. Discoveries in soil chemistry, in the use of fertilizers, in plant and animal breeding, and in other branches of agricultural science, have strongly influenced agricultural conditions in the past and will undoubtedly do so in the future. It is often necessary to reduce the cost as well as to adjust the total volume of farm production to demand; in other words to increase the efficiency of agriculture. Obviously, work done in the department to this end may have a vital connection with our general farm-improvement policy, and hence with the farm board's program. The Department of Agriculture and the Federal Farm Board are allies in the sense that each is designed to perform certain functions, all of which contribute to the same end—the improvement of the economic status of farmers.

THE DEPARTMENT'S FINANCES

The growth and present work of the department as a whole are reflected in its finances. In 1836, when the Commissioner of Patents began distributing a few seeds and plants, he did so without any specific Government authority or aid, except the use of the franks of Congressmen. Congress three years later appropriated $1,000 for the work. In 1849, when the Department of the Interior

was established and the Patent Office merged therewith, the appropriation for agricultural work was $3,500. Modest appropriations for agriculture were continued until the creation of the Department of Agriculture in 1862. The total appropriation for the new department during its first year was $64,000.

By 1889, the year in which the Department of Agriculture was made an executive branch of the Government, the annual appropriations had increased to nearly $2,000,000. Up to that time a large part of the appropriations had been used for the purchase and distribution of seeds and plants. After the creation of the Bureau of Animal Industry in 1884, funds became available for the control or suppression of livestock diseases, and, after the passage of the Hatch Act in 1887, for Federal support to State agricultural experiment stations for research. Comparatively small amounts were appropriated for the investigation of crop production, plant diseases, insect pests, forestry, highways, irrigation, reclamation, ornithology, cattle breeding, and related subjects.

MORE THAN $4,000,000 IN 1900

From 1890 to 1900 the appropriations were gradually increased by Congress and reached a total of more than $4,000,000 in the latter year. The Weather Bureau was established as a part of the department by transfer from the War Department in 1891, and the appropriation for the weather services exceeded $1,000,000 in 1900. For the same year the Bureau of Animal Industry received nearly $1,000,000. Federal payments to State experiment stations under the Hatch Act accounted for $720,000 of the total appropriation. Of the balance, the larger items were for the collection of agricultural statistics and for the distribution of seeds and plants.

For the fiscal year 1906 the department's appropriations were more than $8,000,000. In 1907 a total in excess of $11,000,000 was provided, of which $3,000,000 constituted the first annual appropriation for the enforcement of the Federal meat inspection act. By this time various regulatory and service activities had become important factors in the appropriations of the department, notably the administration of the national-forest reserves, which had been transferred in 1905 from the Department of the Interior to the Department of Agriculture.

By 1917 the department appropriations had grown, by gradual annual increases, to $30,000,000. The Smith-Lever Act, providing Federal appropriations to State colleges of agriculture for extension work, became effective in 1914, and the appropriations thereunder in 1917 totaled $1,580,000. Total payments to State experiment stations for research work under the Adams Act (passed in 1906) and the Hatch Act had been $1,440,000 annually since 1911. The fiscal year 1913 saw the establishment of the Office of Markets and Rural Organization. The appropriation for this unit in 1917

reached nearly $900,000. Additional funds were necessary for regulatory duties imposed upon the department by the passage of the plant quarantine act in 1912, and the cotton futures, grain standards, and warehouse acts in 1916.

WAR EMERGENCY APPROPRIATIONS

When the United States entered the World War in 1917, Congress provided special emergency appropriations for stimulating agriculture and facilitating the distribution of agricultural products. War-emergency appropriations for the fiscal year 1918 exceeded $25,000,000, and brought the total general funds of the department to more than $62,000,000 for that year. War-emergency monies provided for the fiscal year 1919 amounted to nearly $12,500,000 and made the total general funds approximately $50,000,000. In the postwar readjustment period, the level of appropriations was maintained at around the $50,000,000 mark for several years.

Through expansion in the activities of the Bureau of Markets, increases in Federal payments to the States under the Smith-Lever Extension Act, the provision of $3,500,000 for seed loans to farmers, and a general broadening of its work, the department's appropriations in 1922 reached $54,000,000. In 1923, due principally to the elimination of the nonrecurring item for seed loans, the appropriations declined to $52,000,000, but by 1927 the total had risen to $72,000,000. In the intervening period the Bureau of Dairy Industry and the Bureau of Home Economics had become separate units of the department's organization, and practically all phases of the department's work had been expanded. Appropriations provided for the fiscal year ending June 30, 1931, amount to nearly $82,000,000.

FUNDS FOR ROAD CONSTRUCTION

The foregoing figures do not include monies provided for road construction. In 1893, the Office of Road Inquiry was created by the Secretary of Agriculture, an appropriation of $10,000 for the work having been made available by Congress. By 1903 the annual appropriation for this office had risen to $30,000, and by 1913 to $202,120. Prior to 1913 its work was exclusively experimental and educational. In the fiscal year 1913 a special appropriation of $500,000 was made for the building of post roads in cooperation with the State or local units.

The Federal-aid road act of July 11, 1916, provided for a 5-year program of cooperation with the several States, with a total appropriation of $75,000,000 for the 5-year period, beginning with $5,000,000 in the fiscal year 1917, and increasing by a like amount up to $25,000,000 for the fiscal year 1921. This act also carried $1,000,000 a year for 10 years for forest roads and trails, beginning with 1917. Federal-aid road appropriations for 1919, 1920, and

1921 were subsequently increased by $50,000,000, $75,000,000, and $75,000,000, respectively, and $3,000,000 additional for each of these fiscal years was appropriated for forest roads and trails. The total appropriations for Federal-aid highways for 1919 were $65,000,000; for 1920, $95,000,000; and for 1921, $100,000,000. For forest roads the appropriation for each of these three years was $4,000,000.

The existing Federal-aid highway system was established by the Federal highway act of November 9, 1921, which provided an appropriation of $75,000,000 for construction work in 1922, as well as $5,000,000 for forest roads and trails in 1922 and $10,000,000 in 1923. In 1923 Congress adopted a policy of authorizing appropriations for roads, with the actual appropriations to be made from year to year as needed to carry out the authorized road-construction program. Under the acts of April 4, 1930, and May 5, 1930, the authorized appropriations for Federal-aid highways and forest roads and trails were increased to $125,000,000 and $12,500,000, respectively, for each of the fiscal years 1931, 1932, and 1933. The total of the appropriations authorized under the Federal-aid road act of 1916 and supplemental acts, up to June 30, 1933, is $1,200,000,000 for Federal aid to the States, and $122,000,000 for forest roads and trails, as set forth in the following summary:

	Federal-aid highways	Forest roads and trails
1917	$5, 000, 000	$1, 000, 000
1918	10, 000, 000	1, 000, 000
1919	65, 000, 000	4, 000, 000
1920	95, 000, 000	4, 000, 000
1921	100, 000, 000	4, 000, 000
1922	75, 000, 000	6, 000, 000
1923	50, 000, 000	11, 000, 000
1924	65, 000, 000	7, 500, 000
1925	75, 000, 000	7, 500, 000
1926	75, 000, 000	8, 500, 000
1927	75, 000, 000	7, 500, 000
1928	75, 000, 000	7, 500, 000
1929	75, 000, 000	7, 500, 000
1930	75, 000, 000	7, 500, 000
1931	125, 000, 000	12, 500, 000
1932	125, 000, 000	12, 500, 000
1933	125, 000, 000	12, 500, 000
Total	200, 000, 000	122, 000, 000

EXPENDITURES FOR THE FISCAL YEAR 1929

The best financial indication of what the department does is shown by expenditures rather than by appropriations. Certain appropriations carry over from one year to another. Hence, in some years the appropriations for a given item may be relatively small, while the actual expenditures, with funds carried over from a previous year, may be relatively large. The total expenditures of the department for the fiscal year which ended June 30, 1929, were classified as shown in Table 1.

TABLE 1.—*Expenditures for fiscal year 1929 classified by organization units*

Organization unit	General activities	Payments to States (exclusive of Federal-aid road funds)	Road construction (including Federal-aid roads)	Total
Office of the Secretary	$1,176,714			$1,176,714
Office of Information	1,136,893			1,136,893
Library	95,675			95,675
Office of Experiment Stations	397,511	$3,840,000		4,237,511
Extension Service	1,960,751	7,162,936		9,123,687
Weather Bureau	2,956,269			2,956,269
Bureau of Animal Industry	14,349,539			14,349,539
Bureau of Dairy Industry	611,458			611,458
Bureau of Plant Industry	4,620,811			4,620,811
Forest Service	11,648,227	2,610,414	[1]$11,154,207	25,412,848
Bureau of Chemistry and Soils	1,403,007			1,403,007
Bureau of Entomology	2,049,558			2,049,558
Bureau of Biological Survey	1,383,942			1,383,942
Bureau of Public Roads	826,939		85,685,774	86,512,713
Bureau of Agricultural Economics	6,074,718			6,074,718
Bureau of Home Economics	147,554			147,554
Plant Quarantine and Control Administration	4,312,308			4,312,308
Grain Futures Administration	131,359			131,359
Food, Drug, and Insecticide Administration	1,545,134			1,545,134
Seed Loan Office	5,616,992			5,616,992
Total	62,445,359	13,613,350	96,839,981	172,898,690

[1] Includes cooperative and contributed funds.

TABLE 2.—*Expenditures for fiscal year 1929, classified by types of activity*

Type of activity	General activities		Payments to States (exclusive of Federal-aid road funds)	Road construction (including Federal-aid roads)	Total for all purposes	
	Amount	Per cent			Amount	Per cent
Research	[1] $13,969,275	22.4	$3,840,000		$17,809,275	10.3
Extension	2,727,513	4.4	7,162,936		9,890,449	5.7
Eradication or control	12,267,299	19.6			12,267,299	7.1
Service activities	22,526,702	36.1	2,610,414		25,137,116	14.6
Regulatory work	10,954,570	17.5			10,954,570	6.3
Road construction				$96,839,981	96,839,981	56.0
Total	62,445,359	100.0	13,613,350	96,839,981	172,898,690	100.0
Percentage of grand total	36.1		7.9	56.0	100.0	

[1] Expenditures for research work by the department itself (not including payment to States) are 8.1 per cent of the grand total for all purposes.

The classifications set forth in Table 2 include:

(1) Research: Investigations and experiments in animal and plant production, breeding, and improvement, in methods of controlling diseases, insects, and other animal and plant pests, in soil and fertilizer problems, in farm-management practice, in marketing, in crop utilization, in horticulture, forestry, home economics, meteorology, road building, etc., by means of laboratory and field experiments.

(2) Extension work: Demonstration and educational work by means of county agricultural, home demonstration, and boys' and girls' club agents and through exhibits, motion pictures, or otherwise, with a view to the dissemination, by direct contact, of the information developed by the experiments and discoveries of the department and the various States.

(3) Eradication or control: Direct control or eradication of plant and animal diseases, insects, and other pests, through organized campaigns, either independently or in cooperation with State agencies.

(4) Service activities, such as the administration and protection of the national forests, the weather service, market news and inspection services, crop estimating, seed loans, and other work of like character not primarily involving research, extension, or the enforcement of regulatory laws and exclusive of road construction.

(5) Regulatory work: Administration of regulatory laws, including the food and drugs act, the meat inspection law, the plant and animal quarantine laws, the migratory-bird treaty act, the cotton futures and cotton standards acts, the grain standards act, the warehouse act, and other legislation.

(6) Road construction, which includes construction of the Federal-aid highway system and forest roads and trails under the Federal-aid road act and supplemental acts, the Mount Vernon Memorial Highway, special road work in flood-devastated areas, and forest road and trail work paid for from the general appropriations of the Forest Service from national-forest receipts and from funds contributed by Forest Service cooperators.

During recent years there has been increasing interest and financial support for research. Table 3 shows the estimated approximate expenditures for research work for the fiscal years 1923 to 1929, inclusive:

TABLE 3.—*Expenditures for research*

Fiscal year [1]	By department	Payments to States	Total
1923	$9,000,000	$1,440,000	$10,440,000
1924	9,700,000	1,440,000	11,140,000
1925	10,100,000	1,440,000	11,540,000
1926	10,300,000	2,400,000	12,700,000
1927	10,600,000	2,880,000	13,480,000
1928	11,300,000	3,360,000	14,660,000
1929	13,970,000	3,840,000	17,810,000

[1] Funds are appropriated to the various bureaus and offices rather than by functional classifications such as research. The figures given above for the fiscal year 1923 are a rough estimate; figures for the fiscal year 1924 and subsequent years are based upon annual calculations of the approximate expenditure for research.

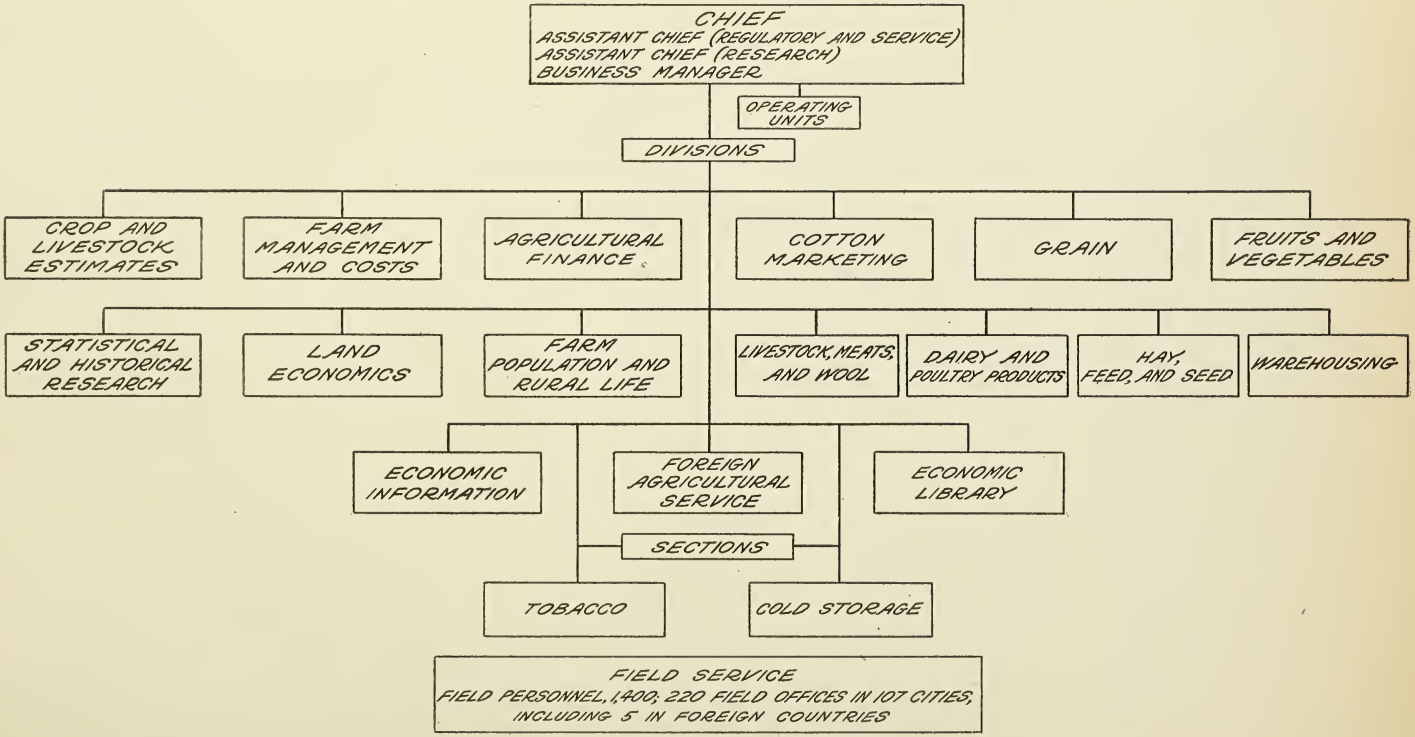
SMALL PROPORTION OF TOTAL FEDERAL OUTLAY

The expenditures of the Government as a whole for the fiscal year which ended June 30, 1929, were approximately $4,700,000,000. The entire expenditure of the Department of Agriculture for 1929, including nearly $97,000,000 for roads, was, in round numbers, $173,000,000, or 3.7 per cent of the total expenditure of the Government. Excluding road funds, the total expenditure by the department for other purposes, namely, $76,000,000, was about 1.6 per cent of the total for the Government as a whole.

The expenditure for roads in the fiscal year 1929, nearly $97,000,000, was 56 per cent of the department's total expenditure. Payments to the States, in addition to those for road construction, amounted to more than $13,500,000, or practically 8 per cent of the total, to cover Government assistance in support of agricultural research and extension work and certain forestry functions carried on in cooperation with the States. This left approximately $62,500,000, or about 36 per cent of the total charged to the department, for direct expenditure by the department for what might be termed its general activities. These are analyzed in detail in Tables 1 and 2.

Among the more important items are an expenditure of more than $6,000,000 annually to combat bovine tuberculosis; an expenditure of more than $5,000,000 annually to insure the wholesomeness of meat and meat-food products entering interstate commerce; and an expenditure approximating $4,000,000 annually for the weather service. Expenditures for the Forest Service in recent years have been in the neighborhood of $25,000,000 annually. Of this amount, about $9,000,000 in the fiscal year 1929 was for the construction of forest roads and trails under the Federal highway act; about $2,000,000 was paid to States for road and school purposes under laws which provide for a return of receipts from the operation of forests; more than $1,000,000 received as contributions from private cooperators was applied to the construction of forest roads and trails; and the remainder, or about $13,000,000, was applied principally to the administration, protection, and development of the national forests.

BUREAU OF AGRICULTURAL ECONOMICS



BUREAUS AND OFFICES OF THE DEPARTMENT

BUREAU OF AGRICULTURAL ECONOMICS

The Bureau of Agricultural Economics is concerned primarily with the economics of farm production and marketing, and with economic policies—land utilization, credit, taxation, etc.—that affect agriculture and farm living conditions. Success in agriculture depends not only on production but also on organization of the farm enterprise in such a manner that maximum net returns may be obtained, and on many other economic questions. The handling and distribution of farm products, as well as production itself, must be efficient. Hence, aside from the strictly technological problems of agricultural engineering and of crop and livestock production, the Bureau of Agricultural Economics deals with all the varied aspects of the problem of making agriculture profitable, and farm life a satisfactory mode of living.

The bureau deals with agricultural problems largely from a broad, national viewpoint. Agriculture should be the source of ample supplies of food and raw materials available at prices that are reasonable to the consumer and yet adequate to provide the basis for a satisfactory farm life. At the same time a proper balance should be maintained between agriculture and other phases of our national life. The primary aim of the bureau is to help bring about these conditions. To this end it concerns itself with the continual changes and shifts in economic conditions that affect agriculture, and studies how farmers may adjust their various activities so as to maintain satisfactory supply and demand relationships.

In short, the bureau is a fact-finding and fact-interpreting institution. In production studies, it deals with the relation of supply to market requirements, with the quality of products that the markets chiefly require, and with methods of increasing the efficiency of farm production. Maximum net profits in agriculture result only when there is a complete coordination of the physical with the economic phases of production. Accordingly, the bureau emphasizes equally the technical economic problems of production on individual farms and the broader problems involved in adjusting production to demand and in advantageously handling and distributing farm products.

PRACTICAL NEEDS SHAPE POLICY

Sociological aspects of agriculture form another concern of the bureau. Conditions of living on the farm and in the farm community are studied with a view to determining facts and indicating possibilities of improvement. To obtain more money for farm families or a larger comparative return, while in itself important, is only part of the problem. The other parts relate to the best use of these increased returns to bring a satisfactory life to the farm family and the farm community. There are many farming areas to-day in which the schools, churches, health facilities, and recreation facilities are so deficient that increasing the income of the individual farmer would not, in itself, provide a satisfactory life for his family in the area in which the farm is located.

The practical, everyday needs of farmers and of agriculture in general are paramount in shaping the bureau's research and service activities, and in its administration of regulatory legislation. Agriculture probably is the world's most competitive industry, and the competition is not merely local and national but world-wide. Moreover, agriculture is subject to hazards of climate and pests over which the farmer has little control. It is, therefore, essential that farmers should be helped as far as possible to anticipate future conditions.

The collection of statistics of agricultural production and the estimating of acreages planted and prospective yields have been important activities of the department since its inception. Knowledge of supplies available and supplies to come is necessary to the plans of both farmers and business men. Elaborate systems of checks and balances have been developed to insure unbiased reports. Practically every farm commodity is covered, and the findings are eagerly awaited and immediately used by the largest exchanges and business houses of the country, as well as by farmers and farm leaders throughout the Nation.

The estimates of crop production and numbers of livestock are not based on judgment figures or opinions, but on returns from more than 300,000 individual farmers, each farmer reporting for his own farm. These estimates are not enumerations. They are systematic attempts, based on samples or other evidence, to estimate the probable outturn of the crops. The aim is to show the probable production as indicated by evidence available as of the date for which the report is issued. Subsequent changes in conditions are taken into account in later reports. The crop-reporting service is generally considered the most adequate and accurate reporting service of its kind in the world. It is furnishing to the grower, to the distributor, and to the consumer invaluable information to replace the wild guesses that were formerly issued from the most varied and often biased sources.

Facts and figures must be analyzed and interpreted if they are to aid producers in planning their production and marketing. Since

1923, the bureau has issued an annual outlook report, a review of the prospective conditions of supply and demand affecting 40 or more important crops. This is supplemented by similar reports, more restricted in scope, issued throughout the year. Significant tendencies in farm production are analyzed, and an attempt is made to indicate the probable trend of supply and demand during the forthcoming year and even for a longer period. During the last three or four years the outlook reports have proved to be about 90 per cent correct.

STANDARDIZATION AND INSPECTION

Commodity standardization and inspection are among the bureau's principal functions, although the establishment and use of uniform standards of quality for farm products is a comparatively recent development. Little had been accomplished in a national way in this field prior to 1913, but since that time much progress has been made. The development of national standards for farm products is essentially a process of evolution, for established trade practices yield slowly to the forces making for change and improvement. In large-scale marketing, however, such standardization is now universally recognized as a basic requirement. Whether or not the producer or the distributor is rewarded for the expense involved in making the necessary classification depends largely on his subsequent marketing practices. The standardization and inspection of farm products, when associated with a wise marketing policy in general, effect substantial savings.

The chief advantages of standardization are: (1) The establishment of a common language between buyers and sellers and other interested parties, and (2) actual separation of products into different grades of market quality. As a basis for trading, a common trade language is indispensable, particularly in the case of commodities like cotton and grain, which are handled very largely in futures contracts. In the case of many commodities not dealt with so extensively in futures, a large amount of business is still done on vague descriptions. This loose method gives rise to frequent disputes. One of the most conspicuous advantages of standardization is its power to prevent trade disputes. When differences arise unavoidably, standardization facilitates the settlement of claims.

Equally important advantages result from the separation of the product into different qualities. For instance, it enables cooperative-marketing associations to pool the products of individual growers, so that lots of different qualities may be assembled in commercially significant quantities. By this means it becomes possible to reflect quality differences in the prices paid to growers. Another advantage is that trading on a quality basis is a great stimulus to better methods of production. In fact, high-quality production can not be expected of the farmer unless he is paid according to quality. Where no standards are recognized, the tendency of the

markets is to pay a flat price based on the average value of the commodities received, a practice that penalizes the producer of superior goods.

Standardization work in the Bureau of Agricultural Economics has two forms: (1) The formulation and mandatory use of standards required by law, and (2) the optional use of standards formulated and recommended after a study of trade requirements. Official standards for cotton, for example, are required under the United States cotton standards act, and must be used in the marketing of cotton in interstate commerce. Under the terms of the United States cotton futures act, all cotton tendered in the settlement of cotton futures contracts must be classed and certified by the bureau through its boards of cotton examiners at delivery points. In like manner, official standards are maintained, and their use is required by law in the merchandising of the principal grains in interstate commerce, when such merchandising is done on a basis of grades. Under the United States grain standards act, all grain sold or shipped or offered for sale or shipment in interstate commerce on the basis of grades must be inspected and certificated according to official standards. Initial inspections are made by licensed inspectors, and the bureau maintains a force of skilled inspectors to supervise the licensed inspectors and to handle appeals from their decisions. Thus, standardization work in cotton and grain has legal force.

Permissive standards for most field products and also for the principal classes of livestock and meats have been developed by the bureau within the last 15 years. Use of these standards, although optional, is increasing steadily, and, in the case of some products, forms the basis for most of their wholesale distribution.

Voluntary inspection and grading service has developed extensively along with the development of the permissive standards. Trained inspectors, at the request of financially interested persons, determine the grade and quality of products offered for inspection and issue certificates as to their findings. In trade disputes, these certificates are prima facie evidence in all courts in the United States, and afford a basis for settlement in terms of definite commodity standards. Approximately 230,000 cars of fruits and vegetables and 31,000,000 pounds of alfalfa hay have been inspected during a single fiscal year, as well as large quantities of many other commodities.

MARKET NEWS SERVICE

Side by side with its standardization and inspection work, the bureau has developed a nation-wide market news service covering all important farm products. This service has become an indispensable factor in the American system of marketing. Reliable information is assembled and made available in time to be used as a basis for action with respect to many problems of production and

marketing. Data and interpretative statements are made available on commodity shipments, market receipts, stocks in storage, imports and exports, prices, the quality and condition of market offerings, and prospective trends of demand and supply. This information facilitates and equalizes distribution, discourages the dissemination of fictitious and misleading market information by unscrupulous persons, places the producer and his marketing organization on a more advantageous basis for bargaining with the usually well-informed buyer, promotes standardization by emphasizing market preferences, aids economic research looking to improvements in marketing methods, and provides information for adjusting production to demand.

The basic information is collected in numerous ways—by trained market reporters who interview buyers and sellers in the markets during trading hours, by telegraphic reports from the railroads on shipments to and arrivals in the important markets, by warehousemen who report stocks in storage, and by numerous contacts with other sources. It is distributed in time for practical use, and every effort is made to improve its timeliness. The bureau operates one of the most extensive leased-wire services in the country. The information is disseminated by market flashes sent over 10,000 miles of leased telegraph lines, by frequent broadcasts over more than 100 radio stations, by the commercial news-dispatch service of the telegraph companies, and by mimeographed reports sent out daily to extensive mailing lists. Thus a picture of the market situation for each of the principal farm commodities, particularly perishables, is kept almost hourly before the interested public.

Such blanketing of the entire country with timely market information pertaining to farm products has decreased the disadvantage of the individual producer and the small shipper who are in competition with the stronger commercial organizations better capable of obtaining for themselves accurate information through far-flung trade connections. The market-news service helps to promote orderly marketing. It has greatly reduced the losses previously sustained through the blind shipment of perishables to glutted markets while other markets were undersupplied. The Federal Government is the only agency in a position to furnish such a service impartially to all concerned on commodities in which there is a nation-wide interest.

ORGANIZATION OF THE BUREAU

The bureau was created in 1921 by consolidating the economic work formerly done in the Bureau of Markets, the Bureau of Crop Estimates, and the Office of Farm Management. Since that time the work has expanded greatly, and the bureau is now organized along two lines—commodity and functional. The commodity divisions are: Cotton Marketing; Dairy and Poultry Products; Fruits and Vegetables; Grain; Hay, Feed, and Seed; and Livestock, Meats, and

Wool. The functional divisions are: Agricultural Finance; Crop and Livestock Estimates; Farm Management and Costs; Farm Population and Rural Life; Foreign Agricultural Service; Land Economics; Statistical and Historical Research; and Warehousing. Each commodity division of the bureau, in addition to its permanent service and regulatory work, conducts research on many problems specifically pertaining to the commodity. Extensive research is conducted by the functional divisions in such fields as farm management, cost of production, credit, insurance, taxation, transportation, land utilization, land tenure and land values, price analysis, foreign competition and demand, and rural life. The bureau maintains an economic library, separate from the department library, and a division of economic information devoted to the publication and dissemination of information.

The bureau has a staff of more than 2,400 employees. More than 250 offices of the several divisions are maintained in various parts of the country. Foreign service representatives are stationed in Europe and in the Orient. Many of the activities of the bureau are conducted under cooperative agreements with State departments of agriculture and markets, agricultural colleges, and State experiment stations.

RESEARCH UNDERLIES MANY ACTIVITIES

As the organization of the individual farm is fundamental to satisfactory returns in farming, the bureau devotes a great deal of attention to farm-management research. This includes not only comparative studies of various farm enterprises in the organization of individual farms as a business, but also cost-of-production studies to disclose weak points in farm practice and to aid in determining those practices that promise the best results. Moreover, attention is given to types of farming and to farm-management problems involved in adjusting output to demand, and in the shifting of regional competition. The present tendency in the bureau is to organize farm-management research on a regional basis and to work more and more in cooperation with commodity specialists and State and local agencies.

Transportation research often follows special problems in response to requests of farmers' organizations and other agricultural agencies. These problems include, for example, the effect of changes in freight rates on production and farm prices, regional competition in farming, and local costs of equipment and other things bought by farmers.

History provides a valuable aid to the agricultural student and research worker and to others who may be called upon to aid in planning public policy in agriculture. Therefore studies in agricultural history are included in the bureau's program.

FOREIGN WORK IS EXPANDING

Foreign work in agricultural economics becomes daily more important. The foreign competition encountered by American farm products must be measured, analyzed, and watched, for this competition is subject to shifts and changes. The bureau's research projects in foreign countries deal with significant developments of farm production and farm technic; with current statistics of production, sale, and export; with trends and prospects. Hand in hand with these projects are those that deal with foreign demand for American farm products. This demand is studied in the same general way as is foreign competition.

The World War brought about many vital changes in supply and demand conditions in European countries, all of which must be charted in so far as they relate to the marketing of American farm products. The possibilities of the full resumption of wheat production in Russia are of vital importance to American wheat farmers, who must be kept informed of developments in this direction from year to year. Beef from Australia and New Zealand is becoming a factor for the American livestock industry to reckon with, as the Argentine industry has been for several years. These are only a few of many instances. To-day civilized countries are so interdependent that American farmers must take cognizance of competition with their wheat, their cotton, their beef products, or their fruits, whether the competition comes from farmers within the United States or from those in Canada, Egypt, Argentina, or elsewhere. Results of these foreign-research projects are now to be made of more vital use to American farmers through the expansion of the foreign agricultural service that has heretofore been conducted by the bureau in a rather limited way.

LAND PROBLEMS FUNDAMENTAL

Utilization of our land resources is one of the most important subjects studied by the bureau. Land-utilization studies yield significant and valuable results to the general public. They point the way toward better State, regional, and national land policies. Such studies involve a cataloguing of all land resources, together with the uses to which each area is adapted; a determination of the present and future need for the products of each kind of land as related to population increase, increased efficiency in farm production, and similar factors; and the outlining of policies that will tend to bring about desirable adjustments in the use of land. Methods used in selling land and in promoting settlement in particular areas are studied with a view to preventing disappointment and loss to the State and to the settlers; to developing the most efficient and economic methods of land use; to directing rational agricultural expansion whenever the desirability of such expansion may be indicated.

Some of the specific studies, now practically completed, that are yielding results of great value are: An extensive study of the methods of land settlement in the Great Lakes States; a study dealing in a broad way with the economic results of our reclamation policies; and a comprehensive survey of the machinery and methods employed by the several States in the encouragement and regulation of land settlement.

Closely related to these lines of research are studies of land tenure and farm real estate. The bureau is obtaining a more complete knowledge of how the farm land of the United States is owned and of the relation of such ownership to the welfare of all groups and of the Nation. The farm real estate situation is surveyed annually to determine the volume of voluntary and of forced sales, the number of foreclosures, the changes in farm-land values, and the influence of the several factors that affect these values. Effort is being made to measure the forces that determine value as a basis for better methods of appraising land for sale, taxation, or credit. All this work looks toward the gradual formation of a conscious national land policy.

CHANGES IN FARM POPULATION

The currents of movement to and from farms are now looked upon by many leading economists as constituting an excellent index of the state of the economic health of agriculture. Farm owners are often slow to shift their occupation under economic pressure, but farm laborers respond quickly. When methods have been worked out whereby accurate current statistics can be secured with regard to the movement to and from the farm, we shall have an index that will respond promptly to changes in agricultural prosperity relative to that of other industries. The bureau is improving its methods of studying these movements, and it may be possible, in the near future, to issue annual or semiannual figures.

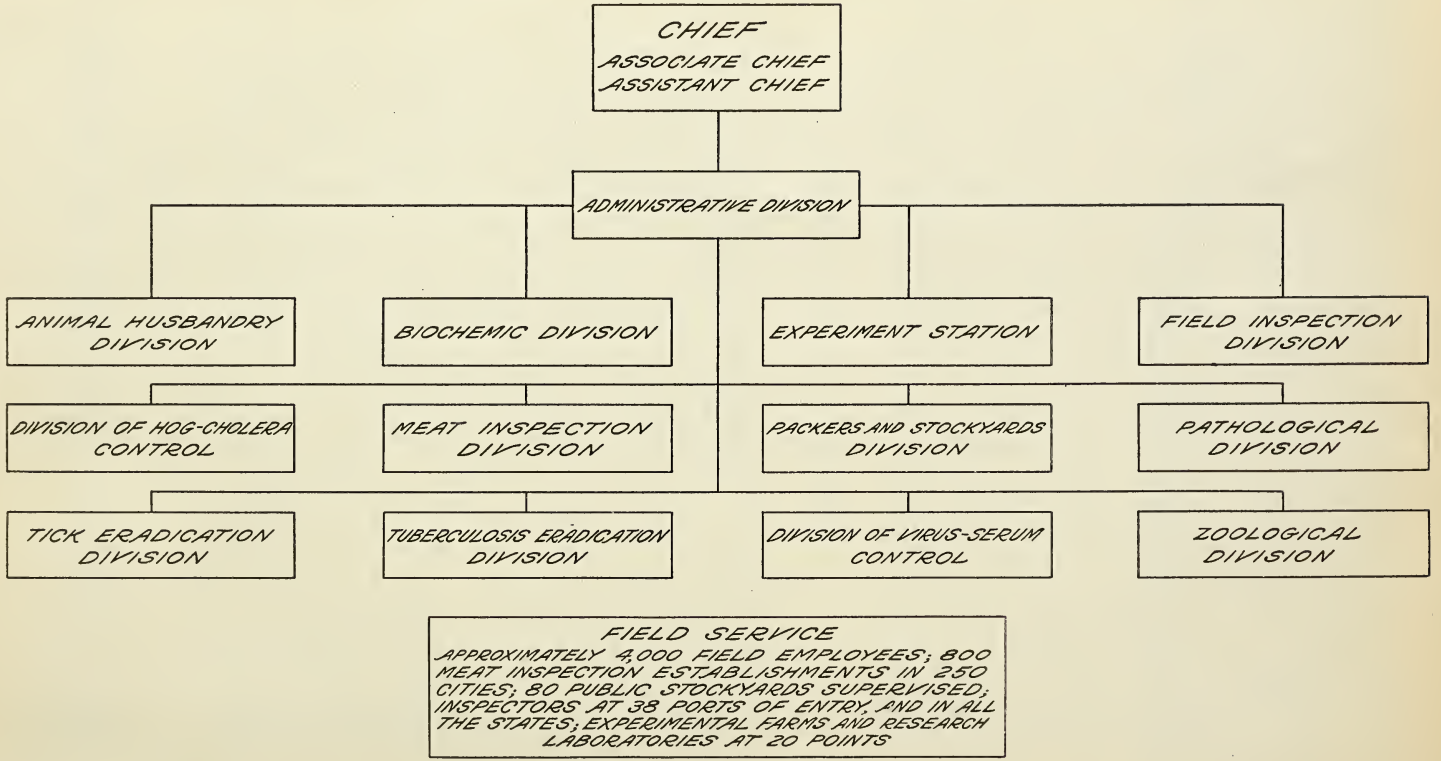
Better production at lower costs, improved markets, better prices, and increased income have as a final objective, so far as farm families are concerned, the improvement of the rural standard of living. To facilitate such improvement, studies are being made of the rural population and rural methods of living. These studies include such subjects as migration to and from farms and the causes and results of such migration, farmers' attitudes toward cooperation and other movements believed to be of benefit to them, standards of living among farmers, hours of labor, and farm-family expenditures.

ADMINISTRATION OF LAWS

Regulatory acts of an economic character administered by the bureau include: The cotton futures act, the grain standards act, the

warehouse act, the cotton standards act, the two standard container acts, the produce agency act, the perishable agricultural commodities act, and the tobacco stocks and standards act. As the processes of marketing become increasingly complex, there is an increased demand for certain improvements through legislation. Economic and practical analysis precedes the formulation of the regulations under any act that is entrusted to the bureau for administration, and the current problems that are brought to light, in the course of administration, are given close study in a search for remedies.

BUREAU OF ANIMAL INDUSTRY



BUREAU OF ANIMAL INDUSTRY

The Bureau of Animal Industry is the branch of the Department of Agriculture chiefly responsible for building up and protecting the livestock industry of the United States.

The scope of its work may be judged from the extent of our livestock production. In recent years the country has contained approximately 180,000,000 domestic animals of major economic importance, principally cattle, horses, hogs, and sheep. It also has contained about 450,000,000 poultry. The average life span of these animals is short, because, in animals raised for food, the market prefers young stock. Accordingly, livestock producers market more than 110,000,000 animals annually, or about two-thirds of the food animals on hand at any one time. Breeding and feeding constantly replenish the supply.

The livestock industry is well distributed throughout the United States. Its greatest development is in the large grazing areas, and in areas where feed can be grown cheaply and abundantly. Besides furnishing an important part of the Nation's food supply, livestock provides raw material for clothing, leather goods, fertilizers, and other commodities. Hence the maintenance and development of the livestock industry are subjects of national concern.

Established in 1884 by an act of Congress, the Bureau of Animal Industry first undertook the eradication of contagious pleuropneumonia, which for a number of years had caused serious losses among livestock in the Eastern States. This disease was stamped out in a few years and has never since gained a foothold in the United States.

FEDERAL MEAT INSPECTION RENDERS WIDE SERVICE

The next important activity of the bureau was the establishment of a comprehensive and effective meat-inspection system that is universally recognized. The system is responsible for the wholesomeness of federally inspected meats and is virtually the basis for our considerable export trade in meats and meat food products. Without the guaranty of Federal inspection, foreign markets would be largely closed against our meat products. Federal meat inspection is conducted at approximately 800 establishments in about 250 cities and towns. These figures vary slightly from year to year.

The inspected slaughter of food animals has ranged in recent years from about 70,000,000 to 75,000,000 head, with swine constituting about two-thirds of the total. Sheep rank next in the slaughter totals, with cattle, horses, and goats following. Horse meat is ex-

ported or used for feeding animals in zoological gardens, and on fox farms, and for similar purposes. Slaughter of horses for these purposes is a comparatively recent development in the United States.

The economy of the Federal meat-inspection service is noteworthy. The average cost is between 6 and 7 cents per animal. This figure includes the cost of inspection before and after slaughter, the inspection of products and imported meats, supervision of labeling, inspection of the cars in which the meat is shipped, and laboratory analyses. Though Federal meat inspection is primarily for the protection of meat consumers, the results of post-mortem examinations help stockmen by furnishing information concerning diseases and ailments found in animals on the killing floor.

PROGRESS IN SUPPRESSING ANIMAL DISEASES

Most of the activities of the bureau have been undertaken to meet specific needs of the livestock industry or to fulfil the requirements of acts of Congress. Methods for reducing losses have been developed through research. The eradication of tick fever in cattle in areas of the South, where this disease was long prevalent, first involved the discovery of the cause. Methods of eradication were a subsequent development. The cattle industry of the South, for many years retarded and hampered by the fever tick, is now greatly improved in the areas in which tick eradication has been completed. Only about one-fifth of the territory infested in 1906, when systematic eradication began, remains under the domination of the parasite, and the area still infested is being rapidly reduced. The beneficial results of the work are evident in better herds of beef cattle and in a more successful dairy industry.

Conquest over demoralizing losses formerly caused by hog cholera has followed research and its practical application. The bureau's Division of Hog-Cholera Control directs field forces in the investigation and suppression of this and other infectious diseases of swine. Closely related work is the administration of the virus-serum-toxin law, to insure high quality in commercial serums, viruses, toxins, and other products for combating diseases. Approximately 90 establishments are licensed for the production of such veterinary biological products, of which anti-hog-cholera serum is produced in by far the largest quantity.

Another extensive undertaking administered by the bureau, in cooperation with various States, is the eradication of tuberculosis from livestock. This work involves the testing of cattle for tuberculosis and the condemnation and removal of animals which show evidence of the disease in their reaction to the tuberculin test. The Federal and State Governments pay the owners of such reactors an indemnity as partial compensation for the loss incurred. Systematic eradication of tuberculosis from cattle began in 1917 and by the end of the fiscal year 1930 had reduced the estimated prevalence of tuberculosis

among cattle from more than 4 per cent to about 1.7 per cent. At times the rate of testing has exceeded 1,000,000 cattle a month. In the fiscal year 1929, 11,683,720 cattle were tested. On July 1, 1930, systematic tuberculin testing had included all the cattle in 976 counties, or nearly one-third of all the counties in the United States.

The Bureau of Animal Industry has conducted research and field activities against numerous other animal diseases and parasites, including the greatly feared foreign plague, the foot-and-mouth disease. Since the bureau was created, six outbreaks of that malady in the United States have been suppressed, and means for preventing further invasion of the disease have been strengthened.

To prevent the introduction of animal diseases into the United States, importations of livestock are controlled by permits. United States quarantine officials will not issue permits for cattle, other domestic ruminants, and swine from countries where any serious diseases exist. Even when permits are issued the animals are carefully inspected, quarantined, and sometimes tested, at the port of entry, to detect the presence of any disease. Animal by-products such as hides, skins, hair, and wool, or any feeds, used bagging, and manure, must be declared free from infection prior to shipment or be handled under careful restrictions after arrival at the port of entry.

PROCEDURE BASED ON SCIENTIFIC KNOWLEDGE

A recent survey of the animal-disease situation shows that of 35 important maladies that afflict livestock in various parts of the world, only 24 are known to be present in the United States. Of these, 17 are being effectively controlled or are approaching complete eradication. The remainder are under partial control or are the objects of further investigation.

To prevent the spread of scabies in cattle and sheep the Bureau of Animal Industry is cooperating with the livestock sanitary authorities in the control and eradication work. Whenever an infected herd or flock is discovered, the animals are dipped in a lime-sulphur or nicotine bath in order to destroy the scab mites. The interstate movement of affected animals is prohibited by law. Exposed animals may be shipped from one State to another after at least one dipping. Exceptions are made when shipments of exposed animals are consigned for immediate slaughter and precautions taken to prevent further infection. When the inspectors at a stockyard discover any trace of scabies in a shipment, the sanitary officials and the Federal authorities in charge of livestock-disease control in the State where the shipment originated are promptly notified. Measures are then taken to locate and treat any affected animals in that locality.

Dourine is a disease which affects horses and asses and is transmitted by the act of breeding. This disease has been practically eradicated from the United States, and the only locality where it

is now known to exist is in northern Nevada. Formerly dourine was present in Montana, North Dakota, South Dakota, New Mexico, Arizona, Wyoming, Nebraska, and Iowa. It was most prevalent on Indian reservations in some of these States. The perfection of the complement-fixation test in recent years has been an aid in detecting the presence of this trouble.

Dourine was first definitely recognized in the United States in 1886, when it broke out in Illinois. It was traced to a stallion imported from France in 1882. The disease was eradicated from Illinois in 1888, but in the meantime an infected animal had been shipped to Nebraska, where the disease broke out in 1892 but was apparently eradicated, although it reappeared in 1899 and again in 1901 in the Pine Ridge and Rosebud Indian Reservations in South Dakota. The work of eradicating the disease was continued persistently with the encouraging results outlined above.

SUPERVISION OF PUBLIC STOCKYARDS

Varied regulatory duties are performed by the Bureau of Animal Industry, among them the administration of the packers and stockyards act. This has a far-reaching influence on livestock production and marketing. The work of the division which administers this act involves supervision over the operations and practices of packers, stockyard companies, market agencies, and dealers, and over the rates and charges made for stockyard services. It includes control over interstate movements of livestock, to prevent the spread of contagious and infectious diseases. Authority to exercise such control was given to the Department of Agriculture by the act of Congress which created the Bureau of Animal Industry on May 29, 1884, and by supplementary acts in later years.

At the principal livestock markets, about 50 in number, employees are stationed who make inspections of livestock received and administer the regulations. Approximately 185 department employees are engaged in this work. Any animals infected with or exposed to a communicable disease must be properly treated or disposed of in such a way as to prevent the spread of the disease. It is thus possible to trace diseased shipments to their point of origin. Local authorities are thereby able to apply prompt control and eradication measures, and to prevent the further movement of diseased or exposed animals.

Another important part of this service is supervision over the cleaning and disinfection of all cars that have been used in the transportation of animals affected with communicable diseases. More than 39,000 cars were cleaned and disinfected under supervision during the fiscal year ended June 30, 1929, either to conform with the regulations, or on the request of Canadian and State officials or transportation companies.

The enforcement of the 28-hour law comes within the scope of the bureau's authority. This law was enacted by Congress to prevent cruelty to animals in transit. The provisions limit the time that animals may be confined in cars without being properly fed, watered, and rested, and require that livestock be handled in a humane manner. Violations of any of these regulations, either by shippers or carriers, are submitted to the Department of Justice for prosecution.

ANIMAL HUSBANDRY INVESTIGATIONS

In its efforts to improve the quality of livestock in the United States, the bureau investigates the breeding, feeding, and management of domestic farm animals and poultry, and studies their products. Beef-cattle investigations, conducted in cooperation with State experiment stations, deal with production, wintering, and fattening in the principal cattle-producing areas.

Swine investigations cover the management of breeding stock, feeder-pig production, the effects of vitamins on growth and reproduction, and the soft-pork problem. The soft-pork investigations have been conducted in cooperation with 13 State experiment stations. Sheep and goat investigations relate to successful methods of sheep husbandry under conditions peculiar to various sections of the country. Research work with wool and other animal fibers is conducted at bureau stations in cooperation with several State stations. Goat studies include experiments with milk goats, and with the Angora breed that produces mohair. Horse studies include the production and use of light horses, the wintering of horses, the endurance and stamina of the Morgan breed, breeding of American utility horses, and the production of saddle and draft types under range conditions.

Poultry investigations include breeding for increased egg production, the fertility and hatchability of eggs, and chick mortality. They deal also with feeding certain food elements to determine their relation to the growth of chicks and to the production of eggs and poultry meat.

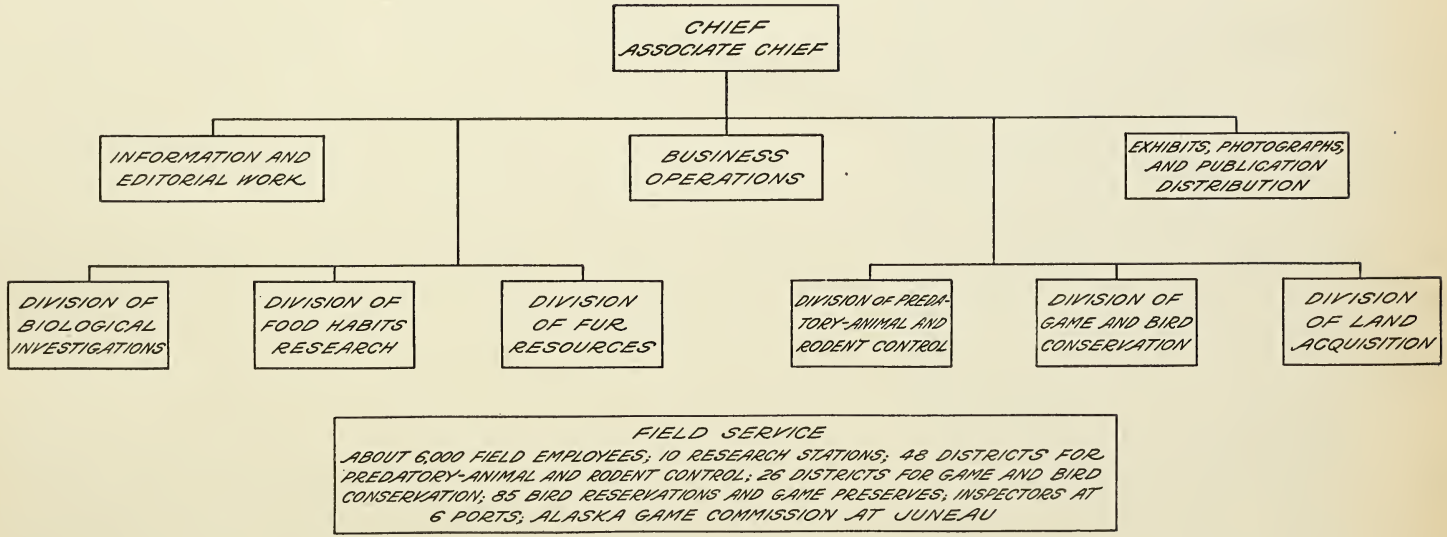
In cooperation with State experiment stations and other agencies, the Animal Husbandry Division conducts investigations and correlates the results of a nation-wide study of factors which influence the quality and palatability of meat. This work includes experiments to determine the effects of chilling, ripening, curing, smoking, storing, and rendering of meats. It includes a study of yields and shrinkages in slaughtering, cutting, and processing. Other studies involve the principles of animal nutrition, and of the variation in products resulting from breeding, feeding, and other factors. Principles of animal breeding are formulated and tested through the inbreeding and crossbreeding of guinea-pig families of known ancestry, and through the inbreeding of swine. The Animal Husbandry Division also issues certificates of pure breeding for cattle, sheep, horses, swine, dogs, and cats imported for breeding purposes.

EXPERIMENT STATIONS MAINTAINED

The bureau maintains farms and experiment stations in those parts of the United States where special problems are being studied, so that dependable methods may be worked out and fully tested. Much technical research work is conducted in laboratories.

In short, the bureau has the following objectives: A better quality of livestock in the United States, improved and more economical feeding, exclusion of livestock diseases and pests from abroad, eradication or control of diseases and parasites causing loss within the United States, a high standard of livestock sanitation, humane treatment of livestock, a high standard of veterinary education, the solution of special problems through research and experimentation, the establishment and maintenance of improved trade practices at livestock markets, cooperation among various branches of the industry and helpful contacts with other industries, and the distribution of information useful to livestock producers and to the public.

BUREAU OF BIOLOGICAL SURVEY



BUREAU OF BIOLOGICAL SURVEY

Various species of wild animals require not only food but areas for feeding, resting, and raising their young. This fact brings many of the better known creatures into competition with farmers, orchardists, stockmen, and others who seek to extend the areas suitable for cultivation, for industrial occupation, and for human dwelling. On the other hand, many species of game, fur-bearing, and other wild animals and birds give us an opportunity for outdoor recreation, and raw materials for food and clothing. Many prey on destructive insect and rodent pests. It is desirable to conserve such species and foster their increase by propagating suitable forms in captivity and by reserving areas adapted to their natural reproduction.

Accordingly the study and administration of certain vertebrate forms of wild life—the mammals, birds, amphibians, and reptiles—have been entrusted to a bureau of the Department of Agriculture, a "wild-life service," called the Bureau of Biological Survey. The remaining group of wild vertebrates—the fishes—are in the jurisdiction of the Bureau of Fisheries, a unit of the Department of Commerce.

Complex and diversified work is involved in the administration of wild-life resources. Specialized research, propagation experiments, control of injurious animals, the maintenance of game refuges, and the enforcement of protective laws are its more important phases. Demands on the Bureau of Biological Survey for information about wild life are constantly increasing. Individuals and organizations want to know its economic value, and how valuable, harmless, and interesting forms may be protected, and harmful or objectionable species controlled. The bureau's conservation and control work is based on the results of prolonged research in practically all parts of the United States and adjacent countries.

COOPERATION WITH OTHER ORGANIZATIONS

Much has been accomplished through cooperation with other organizations. Research is conducted at scientific institutions by cooperators of the bureau. Some studies are financed in whole or in part by interested organizations. In control measures, the States and interested organizations and individuals contribute funds. In some instances such contributions amount to several dollars each year for every dollar spent from the Federal Treasury. Effective cooperation has been afforded in conservation work by sportsmen's associations, State conservation departments, scientific societies and institutions, and individuals.

It is coming to be more generally recognized that campaigns against injurious wild animals are not undertaken for their extermination, but for their control in areas where they interfere with the economic interests and the social welfare of the people, or where they menace valuable mammals and birds. By technical and popular publications and by disseminating timely information, the Biological Survey has measurably influenced the public attitude, and promoted a constructive wild-life policy.

DEVELOPMENT OF THE BUREAU'S FUNCTIONS

The bureau studies the food habits of various species and races, their geographic distribution and migrations, and other phases of their lives. As an aid to these studies it maintains the central records and supervises the work of cooperators in an extensive bird-banding project. It investigates the diseases and parasites of wild life. It experiments in the raising of fur-bearing animals under semidomestic conditions, and collects and distributes information on the propagation of game and ornamental birds and on the care of cage and aviary species. An important duty is the improvement of Alaska's reindeer herds. The administration of land and water areas as refuges for migratory game and other valuable birds and animals is a part of the bureau's work. A related task is the examination and acquisition, by purchase and otherwise, of suitable lands for preserving the steadily diminishing habitat of wild life, particularly for migratory birds and some species of big-game mammals.

The administration of wild-life conservation laws involves not only the drafting and enforcement of regulations concerned with the length of hunting seasons, bag limits, methods of taking game, and rights of possession of migratory game birds, but also with the regulation of interstate traffic in game and other valuable wild mammals and birds and the regulation of the importation of wild-animal life. These diverse duties are performed through a central administrative office and six divisions in Washington, with field forces operating in organized districts or on specialized lines to meet local needs or to conduct local studies.

Many of these activities are the result of recent legislation enacted in response to popular demand. Some, however, are the natural outgrowth of work started when the Biological Survey was established in the Department of Agriculture in 1885, as a section of economic ornithology. A year later the unit was named the Division of Economic Ornithology and Mammalogy. In 1896 it was renamed the Division of Biological Survey. It was raised to the rank of a bureau and given its present designation in 1905. Beginning with studies of the relation of birds to agriculture, the bureau's work has progressively expanded to cover investigations of ranges and migrations of both birds and mammals. Studies of the migration and distribution of birds had been formerly pursued by committees of the American Ornithologists' Union, organized in 1883;

as a result of the efforts of the committees in charge of these subjects the work became a function of the Government. General interest in the work, and the compelling necessity of it, led inevitably to its development as a function of the Department of Agriculture.

Game protection became a duty of the Biological Survey in 1900, with the passage of the Federal Lacey Act. This work was extended in 1902 with the passage of the Alaska game law, again in 1913 with the adoption of the Federal migratory bird law, and was still further extended in 1918, when Congress passed the migratory bird treaty act to enforce an agreement with Great Britain for the protection of birds migrating between the United States and Canada. In 1915 the bureau was authorized to cooperate with States in the control of injurious rodents and predatory animals, and a great extension of its economic functions resulted. Meantime, added responsibilities came to the bureau from the growth of fur farming and of the reindeer industry in Alaska, and from legislation passed for the protection of game and land fur animals in Alaska.

The most recently added functions of the Biological Survey are concerned with the acquisition of suitable land and water areas as refuges for migratory birds. This action was authorized by Congress to make the migratory-bird treaty more effective. Wild-life refuge administration by the Biological Survey, however, was begun as long ago as 1903, when the first of a series of Executive orders and acts of Congress set aside areas of the public domain as reservations for sea birds, big-game mammals, and other wild life.

ORGANIZATION OF THE BUREAU

The six divisions of the Biological Survey are essentially modifications of three that existed at the beginning of the present century. At that time the bureau's functions were grouped under (1) the Division of Economic Investigations, (2) the Division of Geographic Distribution, and (3) the Division of Game Preservation.

The first of these has developed into three divisions—Food Habits Research, Fur Resources, and Predatory-Animal and Rodent Control. The second, with increased responsibilities, is the present Division of Biological Investigations. The third has become the Division of Land Acquisition, and the Division of Game and Bird Conservation, with sections of law enforcement, reservation maintenance, and supervision of foreign importations of wild birds and other animals.

Jurisdiction in the matter of game is both Federal and State. The activities of the Federal Government are for the most part directed by the Biological Survey, though in some instances game protection becomes the function of other Federal bureaus on public domain administered by them. Examples are found in the national parks, where protective functions are performed by the

National Park Service, and on national-forest game preserves, where administration of the game is by the Forest Service or the State, though elsewhere on the forests open seasons and hunting restrictions may be prescribed by State law, particularly with regard to resident or nonmigratory species.

The migrant birds of the country are protected under the terms of the migratory-bird treaty with Great Britain, through the Federal migratory-bird treaty act of 1918 and the migratory-bird conservation act of 1929. Both laws are administered by the Biological Survey. The act of 1918 and the regulations for administering it prescribe hunting seasons and bag limits, prohibit the sale of migratory game, restrict methods of hunting and other activities of hunters and collectors, and permit persons to raise waterfowl in captivity. The act of 1929 provides for the preservation of refuge areas for the birds in their favorite habitats along migration lanes, on breeding grounds, and in winter feeding and resting areas.

SCOPE OF FEDERAL GAME LAWS

The Federal laws for the protection of game and other migratory birds are effective throughout the States, including all areas of the public domain. The States cooperate in executing these laws by making State wardens available to the Biological Survey on occasion for service as United States deputy game wardens, and also by harmonizing State laws with Federal regulations. In some cases birds are protected under State law for longer periods than those provided by Federal regulations. The American code of State and Federal laws and regulations for the protection of birds is recognized the world over, and it has been built up largely on the findings by the Biological Survey as to the economic value of birds.

The Biological Survey aids in coordinating State activities for the conservation of game and fur-bearing animals and nonmigrant birds, such as quail, wild turkeys, pheasants, and grouse. It makes recommendations regarding both artificial game farming and the natural method of providing food, cover, and protection for game. Under the original Lacey Act of 1900 and subsequent amendments, the Biological Survey assists the various States in the enforcement of their laws protecting birds and game and fur animals, by regulating interstate commerce in the wild animals and birds, and by reporting to the States violations of their laws as, for example, when attempts are made to ship to other States wild animals that have been illegally killed or transported in violation of State laws.

Other laws protecting wild life that come within the purview of the Biological Survey are acts for the establishment of specific reservations, an act protecting wild life and property on all Federal reservations (86 of which are now maintained by the bureau), and an act protecting game, fur animals, and birds in Alaska.

CONTROLLING INJURIOUS WILD ANIMALS

It is estimated that coyotes, wolves, mountain lions, bobcats, and some stock-killing bears cause an annual loss of more than $20,000,000. This figure allows for the inroads of predatory animals on game and on ground-nesting and insectivorous birds, as well as on sheep and lambs, cattle, pigs, and poultry. In the fiscal year 1916 the Bureau of Biological Survey began to build up a field force for the control of predatory animals. Predatory-animal districts, each in charge of an experienced leader, were organized in the principal western livestock-producing States. Hunters are not paid on a bounty system, but devote their entire time to the work. Poison campaigns have been undertaken and made effective. The result is a large reduction in the number of coyotes and other predatory animals in the sections covered. Livestock losses have decreased correspondingly.

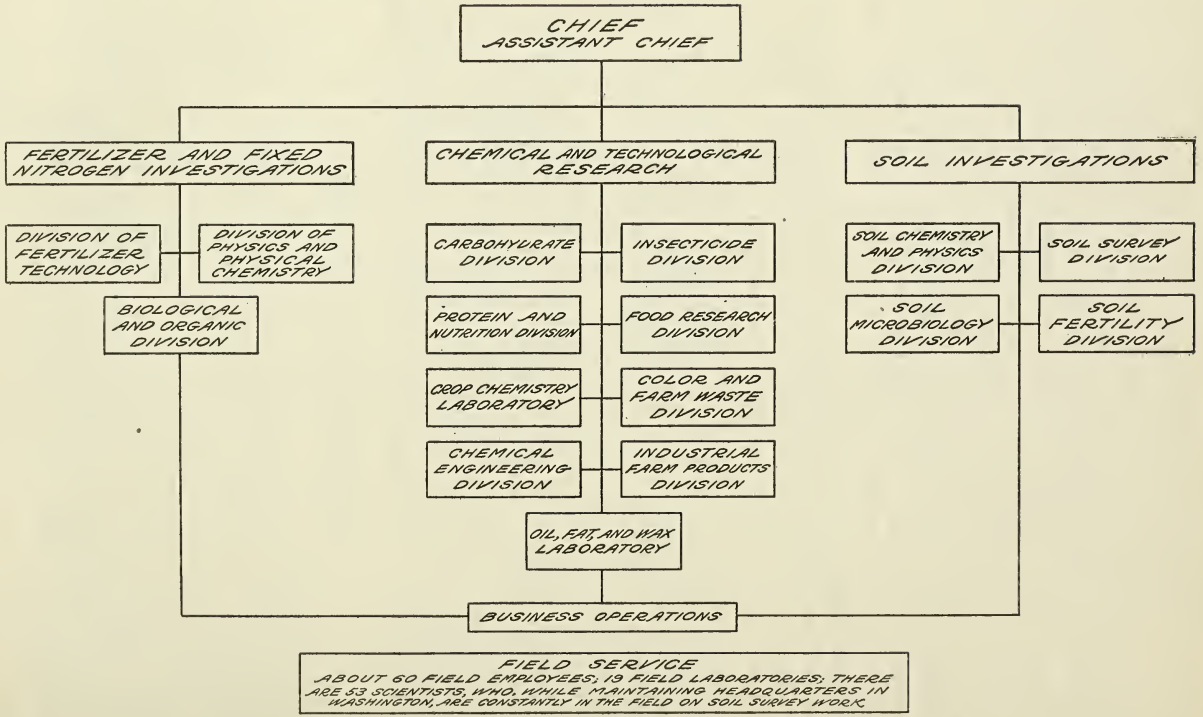
Losses running into the hundreds of millions of dollars annually are caused by ground squirrels, prairie dogs, jack rabbits, pocket gophers, woodchucks, porcupines, mice, and rats. Control of these animals is one of the surest means of reducing the production costs and increasing the profits of agriculture. Much has been accomplished by the department in cooperation with farmers and other landowners. Rodents have been brought under control on millions of acres of valuable agricultural land. In the year 1929 nearly 100,000 farmers took advantage of opportunities offered them to wage cooperative warfare on these pests under trained leadership.

The Seventieth Congress called for an investigation as to the feasibility of a cooperative-control program extending over five or more years. The investigation was made, and a 10-year program was recommended. The object is to prevent the constant reinfestation of cleared areas as well as to clear additional agricultural lands.

PROPAGATION OF FUR ANIMALS

The Biological Survey studies the propagation of fur-bearing animals on fur farms, feeding methods in captivity, means of prevention and treatment of diseases and parasites, management of fur farms, and the utilization of fur products, and makes recommendations for the guidance of fur farmers and others concerned. A fur-animal experiment station is maintained in the Adirondack region, New York, and a rabbit experiment station in southern California, and specialists cooperate with State universities and scientific institutions in studies of the diseases of fur animals.

BUREAU OF CHEMISTRY AND SOILS



BUREAU OF CHEMISTRY AND SOILS

The Bureau of Chemistry and Soils shows American farmers, by maps and descriptions of soils, what crops their lands can best produce, and helps them, by improving fertilizers and fertilizing practices, to grow their crops with greater economy. By finding new uses for farm products it assists farmers to widen their markets and get greater returns from their crops. As new uses for the raw products of the farm are found, opportunities are opened for manufacturers to convert them into useful articles of commerce. Work formerly done by three separate bureaus of the department—namely, the Bureau of Chemistry, the Bureau of Soils, and the Fixed Nitrogen Laboratory, is now consolidated in the Bureau of Chemistry and Soils. There are three units in the bureau—the soil investigations unit, the chemical and technological research unit, and the fertilizer and fixed nitrogen unit.

UTILIZATION OF AGRICULTURAL WASTE PRODUCTS

The annual production by American farmers of more than 100,000,000 tons of cornstalks, which at present are regarded as little better than farm waste, raises the important question: Has the time come for profitably converting cornstalks into paper products? Scientists in the Bureau of Chemistry, now a part of the Bureau of Chemistry and Soils, proved 20 years ago that excellent paper could be made from cornstalks. Recently a book and an edition of a well-known farm paper were printed on cornstalk paper. Several firms are initiating experiments in the manufacture of paper from cornstalks, and the bureau is studying the problem closely from every angle.

Sugarcane bagasse, the remnant of the cane after the juice is pressed out in the cane mills, was considered a waste product until a few years ago. Then it was found that bagasse could be manufactured into paper, and later industrial experimentation showed that it could be made into fiber board and insulation board. To-day these waste products of sugarcane find a ready sale. Specialists in the Bureau of Chemistry and Soils are investigating the possibility of using sugarcane bagasse as feed for livestock, as material for road building, and for making explosives.

A few years ago an appeal was made to the Bureau of Chemistry by the citrus fruit growers of California to develop methods for the use of citrus fruit culls and waste products, which were then costing the growers about $1 a ton to haul away and destroy. This

call resulted in the establishment of a citrus by-product industry, which produces valuable by-products of citric acid, lemon and orange oil, pectin, and other products, which, in 1927, reached a total of approximately $1,000,000.

CHEMICAL AND TECHNOLOGICAL INVESTIGATIONS

The bureau is investigating lignin, one of the three great components of agricultural wastes. Lignin composes 20 to 30 per cent of the dry material of the woody portion of all vegetation. It is estimated that 40,000,000 tons of this material are now lost in the waste liquor from paper mills, and in cornstalks, corncobs, straw, and other farm by-products. Chemists of the bureau recently found that lignin contains eugenol and guaiacol which can be used in the production of drugs.

Specialists of the bureau help the naval-stores industry by demonstrating how to get better turpentine and rosin. Other specialists demonstrate better methods of removing and curing hides. Faulty methods are estimated to cost the producers of hides from $10,000,000 to $20,000,000 annually.

An important contribution to the chemical industry was the invention in the department of a process for the production of phthalic anhydride by the catalytic oxidation of naphthalene. Phthalic anhydride is used in the vat dye and lacquer industries. This process has been of great value. In 1927 the unit sales value of phthalic anhydride was 17 cents a pound, as compared with an invoice value of 24 cents a pound in 1914, when our entire supply was imported from Germany.

Other important work of the bureau includes the biological investigation of foods; experiments on the utilization, for coloring, medicinal, and technical purposes, of raw materials; the improvement of methods for dehydrating food materials; and the development of means to prevent farm fires and dust explosions in factories, grain mills, and cotton gins. The bureau is also working to perfect methods of preserving fruits during shipment and storing, and to perfect insect sprays and poisons for combating insect pests.

FERTILIZER AND FIXED NITROGEN INVESTIGATIONS

No problem of greater importance confronts American farmers than the maintenance of the fertility of their soils. With the increasing depletion of our soils by cropping and erosion, the problem of supplying better and more economical fertilizers becomes more vital to our national well-being. The Bureau of Chemistry and Soils, in its fertilizer and fixed nitrogen laboratory, devises methods for the more economical production and use of the three chief plant foods—nitrogen, phosphorus, and potash.

Until quite recently, most of the nitrogen used by American farmers came from Chilean nitrate of soda, a salt-like substance from the

rainless desert of western South America; from ammonium sulphate, a by-product of our coke ovens; and from such vegetable and animal wastes as cottonseed meal, bones, and dried blood. Methods have now been developed for fixing the free nitrogen of the air into useful chemical compounds. The fixed nitrogen laboratory of the bureau has led in developing this process in the United States. The increase in the supply of nitrogen, with a consequent reduction in its cost, has been of great benefit to the farmers.

The average fertilizer, as applied to the land by present-day machinery, is much less efficient than it might be, because its drilling qualities are capable of improvement and because the distributing machinery used is imperfect. The bureau is helping to overcome this difficulty by combining the ingredient materials of fertilizers into forms which drill with much greater uniformity, and the bureau's studies have resulted in the production of fertilizers with higher concentrations of plant foods, better physical properties, and with no segregation of the various components in the soil. Improvement of these processes, and their adoption by fertilizer manufacturers, should result in important savings.

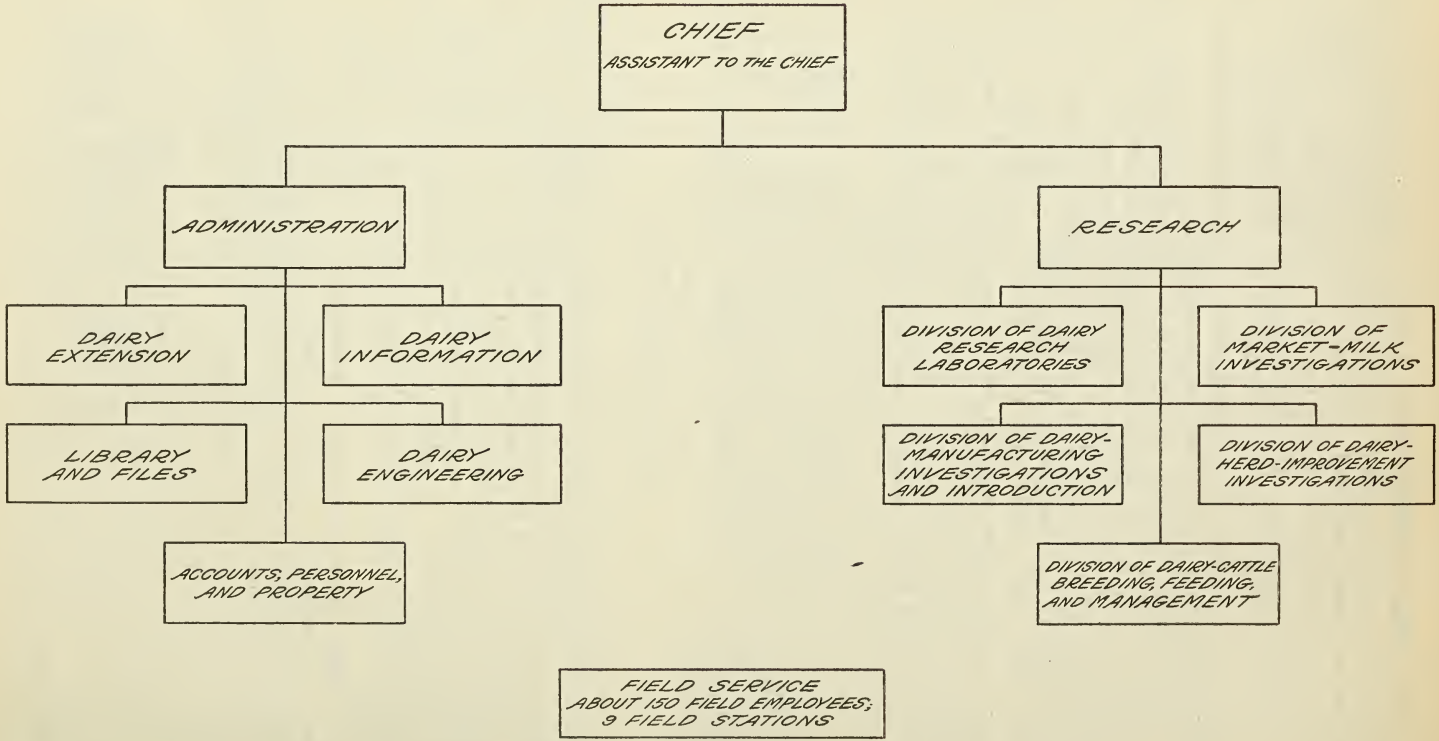
The work of the bureau in advocacy of the use of higher-analysis fertilizers is proving successful. Higher-analysis fertilizers make possible economies in the factory and on the farm. They mean less handling, mixing, bagging, and storing in the factory with less overhead and cost. They mean less freight, less hauling, and less cost on the farm.

SOIL INVESTIGATIONS

The bureau's soil investigations unit is mapping the agricultural area of the United States. It has already mapped and described more than half the area, or approximately 800,000,000 acres. Since the inauguration of the Soil Survey, a little more than a quarter of a century ago, soil areas have been surveyed and mapped in every State and Territory in continental United States, in Porto Rico, and in the Canal Zone. In addition to the extension of the soil-survey mapping, there are ways in which the soil survey has been of inestimable value. The use of the soil survey reports and maps has saved large sums of money by furnishing information for the location of substations and the extension and development of certain crops. Progress has been made in the mapping of muck and peat areas in response to the insistent demand for information regarding these deposits, which are of value not only to agricultural interests but for industrial purposes as well.

The bureau studies the prevention of soil erosion, which results each year in the loss of soil fertility worth millions. It does work in soil microbiology, and investigates the response of soils to fertilizers. In this way a detailed inventory of our soil resources is being made, county by county.

BUREAU OF DAIRY INDUSTRY



BUREAU OF DAIRY INDUSTRY

The Bureau of Dairy Industry is primarily a research organization. It carries on scientific research in the genetics and breeding, feeding, and management of dairy cattle; in the manufacture of milk and cream into butter and cheese and other products; and in the utilization of milk by-products in manufactures and as human and animal food. The bureau helps the dairy industry to apply improved methods suggested by research and by investigations of commercial practice. Briefly, the bureau strives to aid in raising the level of prosperity in the dairy producing, manufacturing, and distributing industries, and to see that the consumer gets wholesome products of high quality.

The Bureau of Dairy Industry was organized July 1, 1924. Previously (1895 to 1924) dairy research and service in the department had been done by the Dairy Division of the Bureau of Animal Industry, which became a part of the new bureau.

The work of the Bureau of Dairy Industry is divided among five divisions: (1) the Division of Dairy Research Laboratories, (2) the Division of Dairy-Cattle Breeding, Feeding, and Management Investigations, (3) the Division of Dairy-Herd-Improvement Investigations, (4) the Division of Market-Milk Investigations, and (5) the Division of Dairy-Manufacturing Investigations and Introduction.

THE RESEARCH LABORATORIES

The bureau's principal chemical and bacteriological laboratories are in Washington. Nutrition research is done in laboratories and in a special nutrition barn at the United States Dairy Experiment Station at Beltsville, Md., just a few miles northeast of Washington. In the Washington laboratories the division has small-scale equipment for manufacturing all kinds of dairy products, so that the commercial possibilities of research results may be indicated. At Grove City, Pa., in a farmers' cooperative creamery known as the Grove City Creamery, the division maintains a research laboratory, at which, under a mutual arrangement, the results of the bureau's research work are tested under commercial factory conditions. The Grove City Creamery was established in 1915, with the aid of the Dairy Division of the Bureau of Animal Industry.

The Division of Dairy Research Laboratories studies the nutrition of dairy cows, and the physiological problems of milk secretion. This work involves research into the protein requirements of dairy cows, and into the mechanism by which the nutritional elements of feed are converted into the constituents of milk. It includes study

of the mineral requirements of the cow for high and efficient milk production, and of the form in which these requirements are best supplied. The vitamin values of various feedstuffs, and the relation of the vitamin content of the feed to the metabolism of the mineral elements of the ration, are studied.

More knowledge of the chemistry and bacteriology of milk is greatly needed in the dairy industry and by distributors and consumers of dairy products. Accordingly the research laboratories of the bureau attack such problems as: What are the factors that control the stability of the suspension of protein in milk? What is the action of acids and rennin in changing the relationships of the various constituents of milk? What change takes place in the oxygen tension in milk due to the growth of bacteria? What factors control the growth and death rates of bacteria? What chemical changes are brought about in milk by the growth of bacteria?

The physicochemical laws involved in making ice cream of the most desirable texture and flavor are not well understood. The ice-cream laboratory studies the influence of the various ingredients, and of the treatment of the ingredients on the viscosity and plasticity of the ice-cream mixture, and the influence of the viscosity and plasticity of the mixture upon the "over-run" in the freezing process. Another problem under investigation is the control of the separation of sugar from the ice-cream mass and the resulting formation of "sand" (sugar crystals) in the ice cream. Still another is how to improve the flavor of the product by treating the constituents of the mixture before freezing.

Condensed milk and dry skim milk are becoming more important in the list of dairy products. The bureau's research work on these products covers processes for concentrating milk in the form of sweetened condensed milk, sterilized evaporated milk, and dried milk. What causes the thickening of sweetened milk in storage? What causes crystals to form in evaporated milk? What causes evaporated milk to curdle in the sterilizing process? What causes the oxidation of fat in a number of dairy products, and thus impairs their keeping quality, and how can this oxidation be controlled? Under what conditions will dry skim milk keep best? What methods of processing and manufacture will produce a particular dairy product best suited to a specific use? Mere mention of these problems suggests the diversity of the bureau's research.

Cheese has been imported into the United States in recent years to the amount of about 75,000,000 pounds a year. The manufacture of this cheese in this country would provide a market for the output of about 150,000 good dairy cows. The cheese is imported mainly because of its high quality. Nearly all the foreign-type cheese made in this country is sold at distinctly lower prices than the imported article. How the American dairy industry may produce foreign-type cheese that will hold its own in the market, is a major subject of research in the bureau.

The economic utilization of milk by-products receives much attention. In the manufacture of butter and cheese, vast quantities of skim milk, buttermilk, and whey are by-products. In a year's volume of these by-products there are about 900,000,000 pounds of protein and about 1,400,000,000 pounds of milk sugar. How these by-products may be utilized to economic advantage is a problem of the first magnitude which the research laboratories are trying to solve.

BREEDING AND FEEDING INVESTIGATIONS

Breeding, feeding, and management are the main stones in the foundation of the dairy industry. These are the chief factors in its production economics. They largely determine what the consumer pays and what the producer earns.

Breeding experiments are carried on by the Division of Dairy-Cattle Breeding, Feeding, and Management with herds at the United States Dairy Experiment Station at Beltsville, Md., and at seven United States dairy field stations located at Huntley, Mont.; Mandan, N. Dak., Ardmore, S. Dak., Woodward, Okla., Jeanerette, La., Columbia, S. C., and Lewisburg, Tenn. These field stations have conditions that are fairly representative of the particular regions in which they are situated. The Huntley, Mandan, and Ardmore stations are on the northern Great Plains; the Woodward is on the southern Great Plains; the Jeanerette in the rice and sugar region; the Columbia in the sand-hill belt of the southern Atlantic coastal plain; and the Lewisburg station in the midst of the general-farming region of the central South. Some of the stations are conducted in cooperation with the State colleges of agriculture.

Breeding done at these stations is designed to develop dairy strains pure in inheritance for high production of milk and butterfat. The method involves the continuous use of sires that have demonstrated, through the performance of their daughters as compared with that of the dams of the daughters, that they can and do transmit to their offspring the genetic factors for high production. Only bulls of proved worth in transmitting the genetic factors for high milk production are used.

Some breeding work is done to compare line breeding with outbreeding, and inbreeding with outbreeding, and to test extreme outcrossing when individuals of families not related within the breed are mated. Experiments in feeding and management are carried on at the same time.

A uniform system of feeding and management is practiced when the animals are being tested for production, and the production records, besides measuring the producing capacity of the cow, yield information valuable in research on feeding. Experiments to compare the relative merits of milking two, three, and four times a day, in feeding different kinds and grades of hay, and in pasture management, yield important data.

At the Beltsville station the fertility of both male and female dairy cattle is studied. The official records published by various dairy breed associations are consulted for facts which may throw light on heredity, and also to locate proved bulls.

A comprehensive program of research into the relation between body conformation and the cow's capacity for production, is under way. Cows no longer useful for other experimental purposes are slaughtered, and their internal organs are weighed and measured. The post-mortem data are studied in relation to external measurements made at regular intervals during the life of the animal. The purpose is to find out what relationship there is between the external measurements and appearance of a cow and the size of her internal organs, and what relation there is between these elements and her producing capacity. By this research the bureau expects to determine whether a deep and wide chest means great lung and heart capacity; whether large lungs and heart are necessary for high production; whether there is a definite relation between the size, depth, and circumference of the paunch and the length and capacity of the digestive tract; and whether great digestive capacity is necessary for high production. The judging of dairy cattle is based largely on theory that may or may not be well founded. It is the purpose of this work to bring out facts upon which to base the judging of dairy cattle. Nineteen State colleges of agriculture are cooperating in this project.

DAIRY HERD IMPROVEMENT

Herd-improvement work done by the bureau is closely related to its breeding, feeding, and management studies. Both lines of activity seek to increase the volume and the efficiency of production per cow, one by developing principles, and the other by helping dairymen to organize and to apply those principles. As yet neither the bureau nor the dairy industry has enough definite information as to the actual economic value of the producing unit of the dairy industry. The average production of the dairy cows of the United States is very low, too low for profit, either under present economic conditions or under any normal economic conditions that are likely to exist. Not until dairymen know which of their cows are profitable and which are not will they be able to eliminate the uneconomic charges which, under present conditions, must be borne either by the producer or by the consumer, or by both. Sound economics demands that the industry maintain only efficient producing units, and the consumer has the right to expect that it will endeavor to do so.

The purpose of the dairy herd improvement association work is to increase production per cow. The bureau and the States cooperating help the dairy herd improvement associations to organize and carry out their purposes. Associations are being organized all over the United States. The association is an organization of dairymen in a community, who unite to get expert services which

individually they could not afford. The association enables the dairyman to know what each cow in his herd produces, and what that production costs him. Then it is easy for him to get rid of the low producers. The next steps are to feed the rest according to their capacity for economical production, and to breed to further increase the average of production. The associations have a two-fold purpose—the improvement of cows and the proving of bulls. At the beginning of 1930 there were on test in these associations more than 500,000 cows whose average production was 7,464 pounds of milk containing 295 pounds of butterfat. This was about 60 per cent above the average production of the 22,000,000 cows in the United States that were counted as dairy cows in the last census.

Records of the associations show, among other things, the relation between milk production and the cost of feed, between butterfat production and income over cost of feed, between the season of freshening and production, between the size of the cow and her production and the income over the cost of her feed, between length of the lactation period and production, between the cost of feed and the income above feed cost, between the kind and quantity of grain and roughage fed and the production of the cow and the income return, and between the production of purebred cows and that of grade cows.

The proving of bulls by these associations is of great economic value. Up to 1930 more than 1,000 bulls in service in these associations had been proved for production. On an average, the use of these proved bulls resulted in an increase of about 5 per cent in the production of daughters over that of their dams.

MARKET-MILK INVESTIGATIONS

The bureau does research and service work to improve the quality of dairy products, as well as to increase production per cow. Dairy producers as a group could increase their aggregate income by millions of dollars a year by taking the precautions necessary to attain and maintain high quality in the product. Sour and off-flavored milk and cream usually are not marketed as advantageously as are sweet products. If the dairyman who offers such products finds a market, the price he gets is low compared with what he could get if he offered high-quality products. The consumption of dairy products might be greatly increased. The per capita consumption of milk in this country is much lower than in a number of other civilized nations. Raising still higher the general level of quality of dairy products is urged by the bureau as a powerful means of stimulating consumption.

The bureau carries on dairy-sanitation investigations, to develop better methods for handling fluid milk and cream. Its quality-improvement work relates to the sanitary treatment of utensils, the care of milking equipment, the cooling of milk and cream to prevent the growth of bacteria in the product, the care of milk and cream

in transit, efficiency in pasteurization, and sanitation in city milk plants. The bureau assists State and local authorities in formulating proposed legislation and ordinances for sanitary safeguarding of the milk and cream supply, and in establishing systems of inspection.

The problems of the city milk distributor are studied to develop means of reducing the cost of processing and delivering milk. Very few foodstuffs are delivered to the consumer as quickly, and in as clean a manner, as milk and cream, but there is still room for improvement. Important studies are under way regarding the creaming property of milk, the whipping quality of cream, the viscosity of cream, and the factors which affect the flavor and odor of milk.

CONTACTS WITH MANUFACTURERS

One of the main functions of the Division of Dairy Manufacturing Investigations and Introduction is to maintain practical contact between the research laboratories and the dairy products and dairy by-products factories of the United States; to study the needs of factories for better methods and processes; to take up these needs with the research laboratories, and then, when the research scientists have found and demonstrated better methods and processes, to help put the research results into commercial practice.

The factories' main current products—butter and cheese—are accompanied by enormous quantities of by-products, skim milk, buttermilk, and whey, which are capable of yielding great quantities of valuable products—casein, lactose (milk sugar) acids, etc. These by-product materials are now largely wasted or are utilized to poor economic advantage as compared with their possibilities. Science must find how these by-products can contribute to the prosperity of the dairy industry. This is one of the biggest tasks in the dairy industry, and consequently stands as an important aspect of the bureau's work.

Another important feature of this division's work is its investigations to determine what factors affect the quality of manufactured dairy products at all stages in the channels of commerce, and to devise ways and means for attaining and maintaining high quality in these products wherever they may be, up to the point of final consumption.

It studies the limit of acidity of cream for the manufacture of butter in relation to the keeping quality of the butter in storage; the quality and shrinkage of butter in storage in relation to the length of time in storage; problems in the transportation of cream from the farm to the creamery; problems in the handling of cream and milk in butter and cheese manufacturing plants, and the relation betwen factory arrangement and efficiency. It investigates problems in the operation of creameries and cheese factories which are especially related to the quality of the butter and cheese made, and cooperates with factory managements and public officials in effecting improvements.

This division introduces into Swiss-cheese factories a new method, known as the "culture method." Use of this method enables the manufacturer to make Swiss cheese of higher quality than that made in this country in the old way.

In the introduction of the best known methods of making butter and Cheddar cheese, the bureau is assisting many factories to improve their product and effect economies in manufacture. In communities where creameries and cheese factories are comparatively new enterprises, bureau experts visit the plants and help to work out better methods.

Methods developed in the bureau's research laboratories for making concentrated sour skim milk have been introduced in about 20 plants which are now making this product. These plants, located in various parts of the country, used more than 76,000,000 pounds of skim milk in 1928 and 1929.

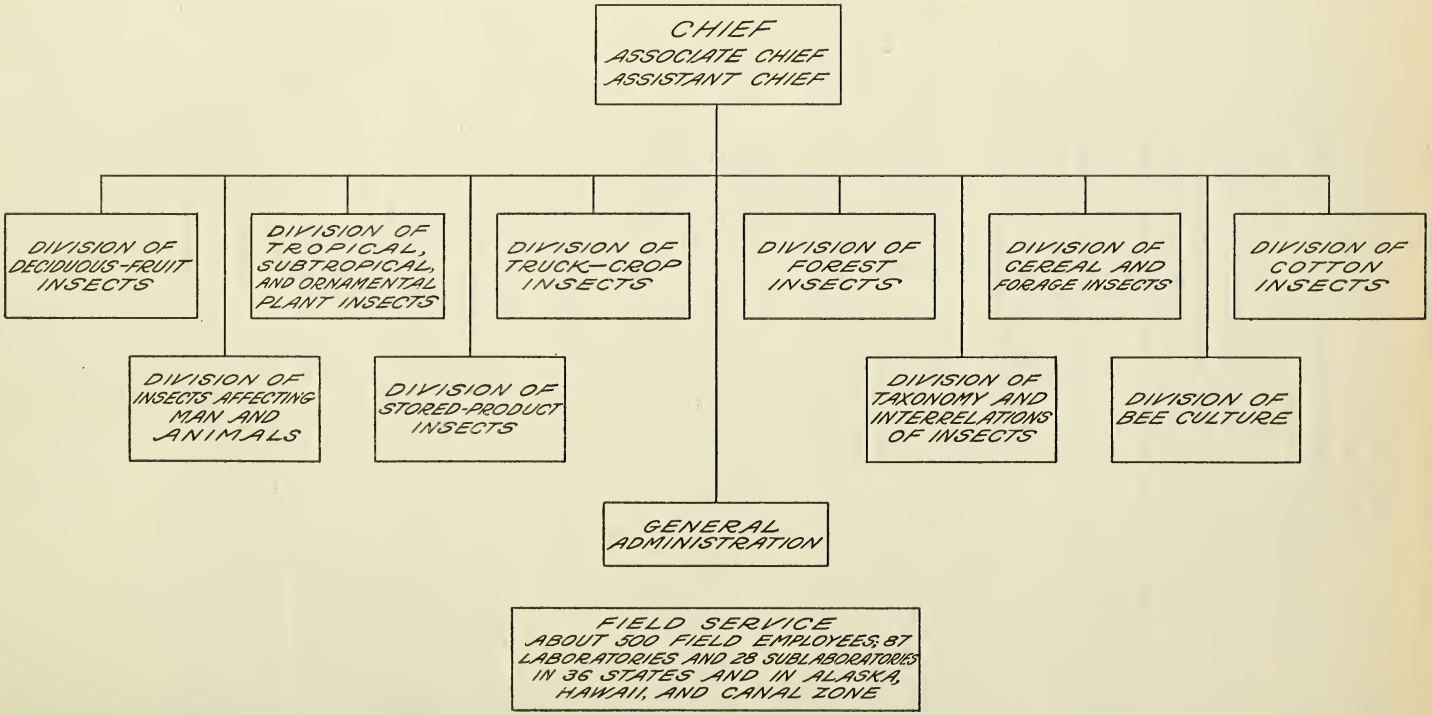
The sanitary inspection of factories making renovated butter is under the supervision of this division. At the beginning of 1929 five such factories in the United States were producing about 3,000,000 pounds of renovated butter per year. They must maintain strict sanitation, and their manufacturing must meet the bureau's requirements.

One of the important features of the bureau's service work at present is the introduction into casein factories of the bureau's method of making casein, known as the grain-curd method. This method yields a product equal to the best foreign product. Casein experts of the bureau are visiting casein plants all over the country, showing them how to manufacture under the bureau method.

EXTENSION AND INFORMATIONAL WORK

The full value of the bureau's work is realized only when the results are applied in farm and commercial practice. So that its research findings may be applied effectively and without delay, the bureau and the Office of Cooperative Extension Work of the department have dairy subject matter extension specialists in the four main geographic regions of the country. These specialists work out, with the State directors of extension work and with State dairy extension specialists all over the country, practical ways and means for getting research results into practice. Through the Office of Information of the department, the bureau issues information to the dairy industry and to the general public, in Government publications, articles in the press, radio broadcasts, and exhibits.

BUREAU OF ENTOMOLOGY



BUREAU OF ENTOMOLOGY

The growth of economic entomology under the Federal Government has been rapid. Appropriations have increased from an annual budget in 1878 of $5,000 to approximately $2,300,000 for the fiscal year 1930. The bureau had its beginning in 1854 with the appointment of an entomologist in the Division of Agriculture of the Patent Office to collect statistics and other information on seeds, fruits, and insects in the United States. The first entomologist worked practically alone. There were only three or four men engaged in the work when the Division of Entomology was established in 1883. The present Bureau of Entomology has a personnel of some 560 employees, including 335 trained specialists.

This phenomenal growth is a result of the important rôle played by insects in our rapidly expanding agriculture. As new lands were brought under cultivation, many native insects turned their attention to cultivated crops, on which they developed in enormous numbers. Increased transportation facilities between all parts of the world brought to our shores many of the worst insect pests of foreign countries. About half our principal insect pests are aliens introduced during the past 300 years. The country has had a succession of important insect problems, beginning with the ravages of the Rocky Mountain locust during the seventies. The Colorado potato beetle became troublesome about the same time, and the cotton caterpillar in the South a few years later. Damage was done by the codling moth to apples; by the Hessian fly and the Angoumois grain moth to the wheat crop; by the chinch bug to the corn crop. The advent of the San Jose scale into eastern orchards about 1890 aroused grave fears for the welfare of our fruit-growing industry. This insect caused many of the States to pass legislation to restrict its spread.

ENTOMOLOGY STIMULATED BY INVASION OF PESTS

Notably increased prominence was given to entomological work when the cotton-boll weevil invaded Texas from Mexico about 1892. Entomology had been stimulated somewhat earlier by the introduction from Europe of the gipsy and brown-tail moths into Massachusetts. The discovery during the late nineties of the transmission of yellow fever by mosquitoes was an additional incentive to entomological effort. More recently certain introduced pests, including the alfalfa weevil, the European corn borer, the Japanese beetle, the oriental fruit moth, the pink bollworm, and the Mediterranean fruit fly, have focused public attention increasingly on insects in

their relation to man's welfare. The great value of the crops menaced and the huge appropriations made for the control of certain pests have impressed the significance of entomological work not only on farmers but on the general public.

Not until 1912 did the Government take steps to protect the United States against the introduction of foreign insects. In that year Congress passed the plant-quarantine act. Losses due to injurious insects have rapidly increased as our country has developed, until at the present time these losses are conservatively estimated at not less than $2,000,000,000 a year. This is in spite of the fact that probably more extensive control operations are practiced in this country than in any other. Hence the rapid growth of the entomological work of the Department of Agriculture, which has been accompanied by a corresponding growth of such work in the States.

FUNCTIONS OF THE BUREAU

The portion of the insect quarantine and related control work formerly assigned to the Bureaus of Entomology and Plant Industry was taken over by the Plant Quarantine and Control Administration in July, 1928. Since then the Bureau of Entomology has been strictly a research institution. The most recent appropriation act charges the bureau with investigations, experiments, and demonstrations for the promotion of economic entomology. Its task includes study of the history and habits of insects injurious and beneficial to agriculture, horticulture, and arboriculture, and also the study of insects affecting man and animals. The bureau seeks the best means of destroying injurious insects. It works both independently and in cooperation with other branches of the Federal Government, and with State, county, and municipal agencies, as well as with agricultural and other organizations and individuals. It cooperates also with foreign governments.

The investigational work is done largely at field stations or laboratories. The number of these stations varies somewhat from year to year. There are at present about 130 laboratories, some of them semipermanent and fully equipped for thoroughgoing research. This is especially true of the laboratories for the investigation of the cotton-boll weevil, the gipsy and brown-tail moths, the European corn borer, the Japanese beetle, the Mediterranean fruit fly, and the alfalfa weevil. The aim is to build up a corps of entomologists capable of furnishing information on all insects that affect mankind. The research work of the bureau is carried out in the following 10 divisions:

DECIDUOUS-FRUIT INSECTS

The Division of Deciduous-Fruit Insects concerns itself with the insects injurious to various fruits, as the apple, pear, peach, plum cherry, grape, cranberry, nuts, and certain small fruits. At present

special attention is given to the codling moth, the oriental fruit moth, the peach borer, the plum curculio, the grape berry moth, the blueberry maggot, and the Japanese and Asiatic beetles. Studies in this field have resulted in many important developments and improvements in the control of fruit insects. Outstanding among these are the paradichlorobenzene treatment for the peach borer; the use of lubricating-oil emulsion for the San Jose scale; the use of calcium arsenate for the control of the blueberry maggot in blueberry barrens; and the use of lead oleate, lead arsenate, and other insecticides for the Japanese beetle.

TROPICAL, SUBTROPICAL, AND ORNAMENTAL PLANT INSECTS

The Division of Tropical, Subtropical, and Ornamental Plant Insects is concerned with insects injurious to citrus fruits, avocado, guava, loquat, date, and other subtropical cultures. It studies greenhouse insects, as well as insects affecting ornamental plants grown out of doors, except hardy shrubs, and insects injurious to bulbs. Some important investigations are under way in this field, including large-scale investigations of the biology and control of the Mediterranean fruit fly and the Mexican fruit worm; the possible resistance of scale insects in California to hydrocyanic-acid gas; treatments for the destruction of insects in bulbs; the importation of parasites of white flies (in cooperation with Cuba).

TRUCK-CROP INSECTS

Insects affecting miscellaneous vegetables are studied by another bureau division. In this classification fall the various insects injurious to truck and garden crops, including sugar beets and tobacco. Particular attention is given just now to major insect pests, such as the Mexican bean beetle, the sweetpotato weevil, the sugar beet leaf hopper, the tobacco hornworms, miscellaneous wireworms, and the cucumber beetles. In the beet leaf hopper work, ecological studies have been made which permit of reliable predictions of the probable abundance, and hence the destructiveness, of the insect in the area under investigation. These predictions enable the growers to govern their plantings accordingly.

INSECTS AFFECTING FOREST AND SHADE TREES

Insects injurious to forest trees, forest products, shade trees, and hardy shrubs are investigated by the Division of Forest Insects. The tree-killing bark beetles of the genus Dendroctonus receive major attention. Termites, which destroy foundation timbers under buildings and woodwork generally, are investigated, as well as insects injurious to manufactured wood products, telephone poles, and so on. The insect enemies of shade and park trees, as well as shrubs, receive such attention as the funds available permit. This division has charge of investigations relating to the gipsy, brown-tail, and satin moths, and imports parasites of these insects.

CEREAL AND FORAGE INSECTS

The Division of Cereal and Forage Insects investigates insects injurious to cereal and forage crops, including sugarcane and rice. Insect losses in this field are heavy, and the insects are not in general amenable to the control measures used for many other insect pests. The division has charge of investigations relating to the European corn borer. It studies cultural and handling methods, and imports parasites of the borer in large numbers. Especially good results have attended efforts to control the alfalfa weevil by poisons. The use of poisoned baits against grasshoppers, delayed planting of wheat to avoid Hessian-fly injury, and other methods, have proved effective.

COTTON INSECTS

Headquarters for cotton insect investigations are maintained at Tallulah, La. Important field stations are also maintained at other points in the South and Southwest. The principal pests under investigation are the cotton-boll weevil and pink bollworm. Experiments have demonstrated the effectiveness of calcium arsenate in boll-weevil control. Studies of the pink bollworm are under way in western Texas to develop satisfactory methods of avoiding injury by this insect. The Thurberia weevil, the cotton caterpillar, the bollworm, the flea hopper, the cotton aphid, and other minor pests are under investigation by the cotton insects division.

INSECTS AFFECTING MAN AND ANIMALS

Insects affecting man and animals are studied by a newly established division which brings together in the bureau all investigations relating to such pests as the house fly, mosquitoes, body louse, and chiggers affecting man, and the cattle grub, screw worm, stable fly, and chicken lice affecting animals. Particular attention is given to mosquitoes, sand flies, and to gnats believed to be concerned in the dissemination of pink eye of man. Among livestock insects the cattle grub, the screw worm, and certain mites and insect pests of fowls receive particular attention.

INSECTS AFFECTING STORED PRODUCTS

The Division of Stored-Product Insects investigates the various insects which attack stored agricultural products, both raw and manufactured, as well as insects that inhabit houses, warehouses, flour mills, and similar structures. Major attention is given to the development of fumigants useful in destroying insects that infest food and other commodities. Insects infesting furniture in houses and warehouses are studied, and also the moth proofing of clothing.

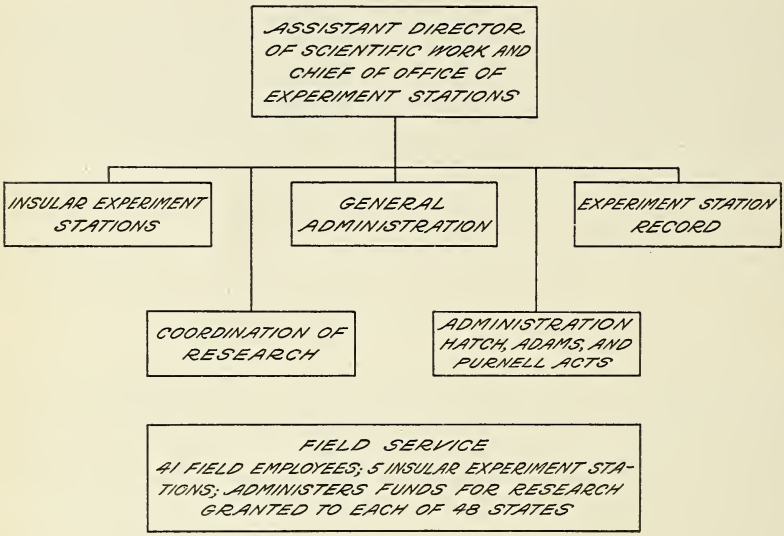
TAXONOMY AND INTERRELATIONS OF INSECTS

A number of important activities are grouped under the Division of Taxonomy and Interrelations of Insects. These include, among others, investigations in taxonomy, insect pathology and morphology, bioclimatics, and the insect-pest survey. The insect-pest survey reports from month to month the existence and progress of outbreaks of injurious insects. Large numbers of insect pests are received for identification from all parts of the world. This service is of great value to entomological workers. The division has also certain other duties, such as the exchange of useful insects, and research into the bacterial and other diseases of insects.

BEE CULTURE

The Division of Bee Culture concerns itself with investigations to make the production of honey more profitable to the beekeeper and with research in the use of bees for pollination purposes. It studies the behavior, the diseases, and the physiology of bees. It investigates regional beekeeping methods and makes demonstrations in beekeeping.

OFFICE OF EXPERIMENT STATIONS



OFFICE OF EXPERIMENT STATIONS

The Office of Experiment Stations represents the department in the administration of the Hatch, Adams, and Purnell Acts, which provide $4,320,000 ($90,000 to each State) annually for the support of the State agricultural experiment stations. It also supervises the use of the funds (amounting to $262,000 for the fiscal year 1930) appropriated by Congress for the maintenance of agricultural experiment stations in Alaska, Hawaii, Porto Rico, Guam, and the Virgin Islands. The office is required to ascertain whether the funds are used in accordance with the acts authorizing them; to aid in coordinating the work of the stations with that of the department; and to report annually on the work and expenditures of the stations.

RELATIONS WITH STATE STATIONS

In addition to its administrative duties under the Federal acts, the office has advisory relations with the experiment stations with regard to all of their activities, which now involve a total annual expenditure, including the Federal funds, of over $16,000,000. In this capacity the office deals with questions of organization and administration, personnel, equipment, lines of work, formulation and coordination of projects, and cooperation. Representatives of the office visit each of the State experiment stations annually to confer with their officers, to examine and report upon their work, and to give such advice and assistance as may be deemed helpful in organizing and developing their research.

Records are kept of all research projects of the stations, now numbering some 7,000, particularly those supported by Federal funds and those carried on in cooperation with the department and by groups of stations. Projects supported by the Adams and Purnell funds are examined and approved by the office before they are undertaken by the stations.

EXPERIMENT STATION RECORDS

In the Experiment Station Record, published in two annual volumes of about 1,000 pages each, with detailed author and subject index, the office gives a current technical review of the publications of the Department of Agriculture and of the agricultural experiment stations, and of other scientific literature pertaining to agriculture and home economics, with editorials and notes on developments in agricultural research and the progress of institutions for agricultural education and research throughout the world. In addition

to the Record, the office prepares and publishes information regarding personnel, legislation, publications, and other matters relating to the organization and work of the experiment stations.

INSULAR EXPERIMENT STATIONS

The Division of Insular Stations prepares budgetary estimates for the operation and general support of the experiment stations in Alaska, Hawaii, Porto Rico, Guam, and the Virgin Islands; aids in maintaining a staff of efficient workers at each station; advises as to lines of work and methods; has charge of the publication of their bulletins and reports; and assists in outlining policies for the benefit and improvement of agriculture of the regions which they represent.

Authority for the Territory of Hawaii to share in the benefits of the Hatch and supplementary acts was given by an act of Congress approved May 16, 1928. The legislature of the Territory designated the University of Hawaii to receive the funds thereby appropriated. It is required by the act that the station shall be conducted in collaboration with the Federal experiment station in Hawaii on cooperative plans approved by the Secretary of Agriculture. Accordingly, the two stations, by agreement between the department and the university authorities, were merged for the purposes of their agricultural work. The resulting institution is known as the Hawaiian Agricultural Experiment Station and is conducted jointly by this department and the University of Hawaii. The director of the Federal experiment station became director of the joint institution. Several members of the university faculty were added to the staff of the experiment station.

By an act of Congress approved February 23, 1929, benefits of the Hatch Act are to be extended to the Territory of Alaska. It is provided in the law

> That no appropriation shall be made under this Act until annually estimated as to funds and amounts by the Secretary of Agriculture; the estimates to be based upon his determination of the ability of the Territory of Alaska to make effective use of the funds.

Plans contemplate the establishment of a new station. It is proposed that the experiment station operated by the department since 1907 at Fairbanks shall be merged with the new organization. The program requires Territorial appropriations for buildings and maintenance, and for some enlargement of personnel, so that research work can be carried on after the department withdraws.

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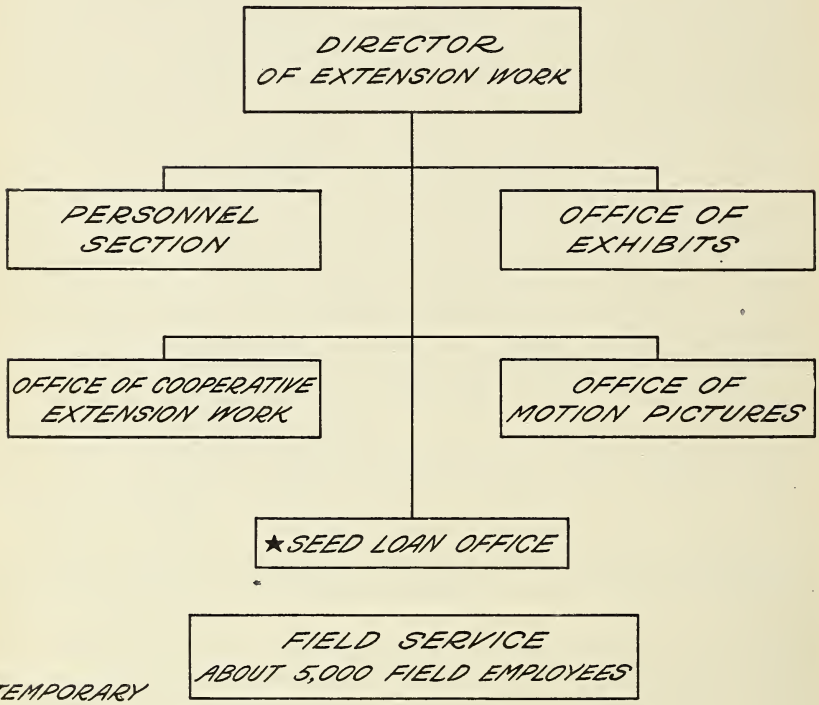
EXTENSION SERVICE



★TEMPORARY

EXTENSION SERVICE

The Extension Service of the Department of Agriculture aids in making available the results of research and investigation in agriculture and home economics to those who can put the information into practice. The service consists of the Office of the Director, the Office of Cooperative Extension Work, the Office of Exhibits, and the Office of Motion Pictures.

The Office of the Director, which was created by Congress and began its work in 1923,[3] coordinates the extension activities of the bureaus of the department and of the State agricultural colleges, supervises the administration of the personnel and funds of the Extension Service, and deals with emergency situations involving department assistance to farmers following floods or other catastrophes.

The Office of Cooperative Extension Work represents the department in the conduct of cooperative extension work in agriculture and home economics by the State agricultural colleges and the department under the Smith-Lever and Capper-Ketcham Acts of Congress. The 48 States and the Territories of Hawaii and Alaska each have a State director of extension who represents jointly the department and the State agricultural college in the administration of extension work.

ORGANIZATION WITHIN THE STATES

In each State the organization consists of a State administrative and supervisory staff with headquarters in most cases at the State agricultural college, and county extension workers who have their offices usually in the county seats. County agricultural extension agents are employed in 2,350 agricultural counties and home demonstration agents in 1,200 counties. Work with farm boys and girls is carried on in counties having extension workers by the agricultural and home demonstration agents, by assistant agents, or by club agents. There are nearly 4,200 county agricultural, home demonstration, and club agents, 400 supervisory officers, and 1,200 extension specialists.

Before 1914, when the Smith-Lever Act was passed, the department and some of the State agricultural colleges had done some extension work. The Smith-Lever Act and specific agreements between the department and the colleges of agriculture pooled Federal

[3] A History of Agricultural Extension Work in the United States, 1785–1923, by Alfred C. True, may be purchased from the Superintendent of Documents, Washington, D. C., for 75 cents per copy.

and State extension activities and funds in one national cooperative system. The extension activities of the department were put into a new States Relations Service, which functioned until 1923, when the present Extension Service was formed.[4]

The Smith-Lever Act specifies that the funds supporting cooperative extension work shall be expended to impart information "through field demonstrations, publications, and otherwise." It limits the amount to be spent on publications to 5 per cent of each annual appropriation. This provides the distinguishing feature of extension teaching. People are not merely told that the methods advocated are desirable; they are persuaded to try these methods, or to watch a neighbor try them so as to determine their merits for themselves.

ALL ASPECTS OF FARMING COVERED

The county agricultural extension agents now deal with every phase of farming. Before the cooperative extension system was established the chief concern of the South was to meet conditions brought about by the spread of the cotton-boll weevil. In the Northern States programs were less uniform but in general were built around the questions, What are the difficulties met with in farming in the community? and What can be done to remove them? The World War began shortly after the establishment of the cooperative extension system, and production was practically the sole phase of farming that was emphasized for some time. After the war agricultural depression focused attention on economic problems, and the extension programs made more use of economic information. Production technic and economic questions are now dealt with as interrelated.

Farm boys and girls show great interest in agricultural extension. Some of the earliest demonstrations in the cotton-boll weevil area were carried on by the young people of the farms. Boys' and girls' 4-H clubs, conducted by extension agents, have grown up. In these clubs the boys and girls train head, hand, heart, and health. The four H's of the club name are derived from this 4-sided training.

Club members range in age from about 10 years to 20 years, each State making its own regulations. Members demonstrate approved practices in farming or home making. In addition, club members attend regular club meetings, exhibit work at fairs, take part in the competitive judging of agricultural or home-economics products, and attend courses at the State agricultural college for 4-H club members. Many spend several days during the summer in a county 4-H camp.

Large numbers of 4-H club members have carried on demonstrations in the growing of corn, cotton, potatoes, tobacco, home gardens, dairy and beef cattle, hogs, sheep, poultry, forestry work

[4] Cooperative Extension Work, 1924, with a Ten-Year Review, may be obtained from the department as long as the present supply lasts.

food preparation, food preservation, meal planning and preparation, the making, care, and selection of clothing, room improvement, and planting of the home grounds. Each club member is asked to keep a record of his work. The annual reports of extension workers show that the percentage of club members carrying their club undertakings through to completion has increased slightly each year. The enrollment in 4-H clubs has also increased annually, amounting now to about 800,000.

HOME DEMONSTRATION WORK

Home demonstration work received impetus from the World War, when food preservation was important. Work in selecting and preparing foods, in making the farm home beautiful as well as comfortable and efficient, in home management, and other subjects has been added to the program. Farm women participating in home demonstration affairs give attention to improvement in civic and social matters.

Funds for cooperative extension come from Federal, State, and county appropriations and from local organizations and individual contributors. Federal appropriations are authorized by the Smith-Lever Act of May 8, 1914, the Capper-Ketcham Act of May 22, 1928, and supplementary acts of Congress. Some funds are carried in the annual appropriation act for the Department of Agriculture. A portion of the funds is available to each of the 48 States and the Territories of Hawaii and Alaska, without an equivalent appropriation by the State or Territory; the remainder, which is divided among the States and the Territory of Hawaii in the proportion that the rural population of each bears to the total rural population of the 48 States and Territory of Hawaii, must be matched by equal State or Territorial appropriations.

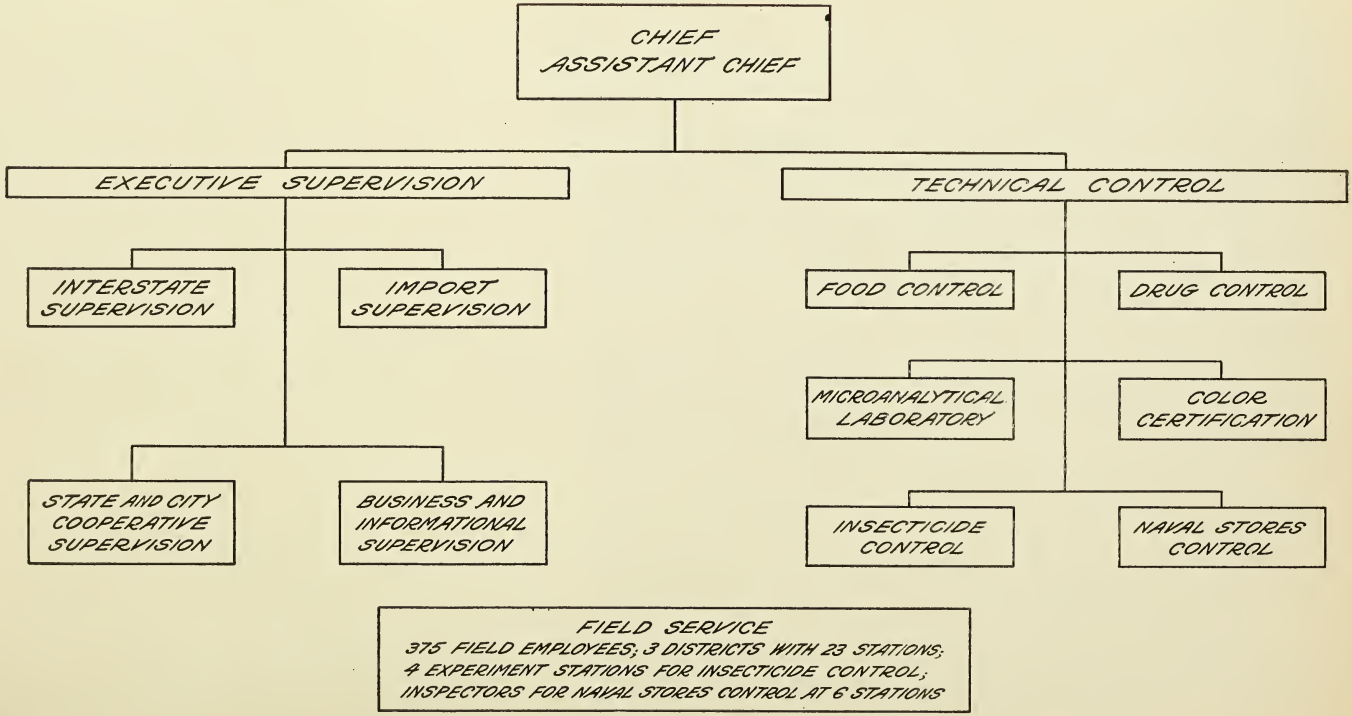
The Office of Exhibits designs, prepares, and arranges to display exhibits relating to the work of the department at State, interstate, and international fairs and expositions within the United States. It also designs, prepares, and arranges to display exhibits under special appropriations for such occasions as the World's Poultry Congress, and international expositions either within the United States or abroad. It is responsible for all exhibit activities of the department. The office has department exhibits at approximately 70 fairs and expositions throughout the United States each year.

The Office of Motion Pictures produces motion pictures illustrating the subject-matter information of the department and the State agricultural colleges, and distributes motion-picture prints to extension representatives and others cooperating in agricultural education. The department now has motion-picture films on about 250 subjects. Approximately 11,000 reels are sent out annually.

THE EXTENSION SERVICE AND THE FEDERAL FARM BOARD

When the agricultural marketing act was passed in 1929 and members of the Federal Farm Board were appointed, considerable impetus was given to extension work in marketing. The Extension Service was requested by the board to conduct the educational activities necessary to carry out effectively the provisions of the act. Extension agents throughout the country have been instructed to carry the proper interpretation of the act and the functions of the board to the farmers. The extension agent advises farmers to market their crops and livestock through local cooperatives organized in accordance with the requirements specified by the board; he helps farmers to select the right varieties needed to satisfy market demands, to grow them in a manner that will produce the highest quality, to prepare the products in the proper way to bring the best returns, and to place them on the market at the right time. Extension workers assemble information concerning the need for cooperative organizations of various producers; cooperate with State and Federal agencies in assembling and analyzing data that will be helpful in planning organization programs and in providing cooperative associations with information upon which they can base changes in their organization to bring them within the scope of Federal requirements; furnish advice to farmers concerning the type of cooperatives to organize; advise with existing cooperatives; procure available printed economic material for growers; and in many other ways help the Federal Farm Board in providing the farmer with complete information regarding the practical application of the principles of profitable merchandising to the marketing of agricultural products.

FOOD AND DRUG ADMINISTRATION



FOOD AND DRUG ADMINISTRATION

The Food and Drug Administration, organized on July 1, 1927, was created by Congress upon the recommendation of the Secretary of Agriculture for the purpose of promoting purity of content and truthful labeling of foods, drugs, insecticides, and certain other commodities, which are essential to the public health and economic welfare of the Nation. This purpose is accomplished through the enforcement of six specific acts of Congress. Four of these acts had been enforced for a number of years by other organization units of the department.

The food and drugs act, commonly called the pure food law, which prohibits commerce in adulterated or misbranded manufactured or natural foods, beverages, stock feeds, drugs and medicines, was enacted in 1906 and has proved to be an instrument of the highest importance both economically and from the standpoint of public health. The insecticide act, passed in 1910, aims to protect farmers, fruit growers, stock and poultry raisers, and others from insecticides, fungicides, and disinfectants that fall below the strength claimed for them, that will not accomplish the results promised, or that are injurious to plants or animals. The import milk act prohibits the entry into the United States of milk or cream that has not been produced under prescribed sanitary conditions from healthy herds or that does not meet certain specified standards at time of entry. The caustic poison act, by requiring certain labeling, aims to safeguard the household against accidental injury from ammonia, lye, carbolic acid, and other dangerous compounds commonly used in the home. The naval stores act applies to rosin and turpentine used in the manufacture of paints, varnishes, and other commodities. The tea act provides for the examination of all tea offered for entry into the United States and the admission of only such tea as meets the standards of quality, purity, and fitness for consumption set by the Government. Because of the volume and variety of the products subject to these acts, there is required for their enforcement a unique organization and a very definite plan of operation.

PLAN OF ORGANIZATION

The personnel of approximately 530 includes administrative officers, chemists, bacteriologists, physicians, veterinarians, entomologists, plant pathologists, microscopists, pharmacologists, inspectors, and other specialists, with the necessary complement of clerks and helpers. Branch stations, manned by specialists, are maintained in 18 commercial cities of the United States to supervise interstate and foreign commerce in foods, drugs, insecticides, fungicides, naval

stores, and caustic poisons. Each station is responsible for seeing that the six acts enforced by the Food and Drug Administration are complied with by the manufacturers, dealers, and importers who trade within a specified territory tributary to the city in which the station is located. There is also maintained a station in Porto Rico, and an import milk station at Rouses Point, N. Y. The station territories covering the entire United States are organized into an eastern, a central, and a western district, with headquarters, respectively, in New York, Chicago, and San Francisco. A responsible administrative officer directs the work of each district.

The Washington staff, consisting of approximately 200, is organized into executive supervisory officers and technical control laboratories to administer the various acts, to recommend methods for attacking regulatory problems, to conduct necessary investigations, and to solve the more difficult technological problems. At the head of the organization are the chief and assistant chief, who direct and coordinate the work at Washington and throughout the entire country.

PLAN OF OPERATION

To supervise effectively the enormous traffic in foods, drugs, insecticides, caustic poisons, and naval stores throughout the entire United States with a staff necessarily limited, it is essential that a very definite plan of operation be formulated and carried out. The great majority of manufacturers are honest and desire to put out good products, truthfully labeled. If those manufacturers who do not put out a legal product can be segregated, it is possible to center attention upon these concerns and effectively supervise their operations. Accordingly, very thoroughgoing factory inspections are made and data collected which indicate the nature of the practices and products of the manufacturing concerns whose products come within the jurisdiction of the acts enforced. At the beginning of each year a program of work is developed that aims to insure that the major attention shall be given to the most flagrant abuses. This enables all districts and stations to work in unison toward a common object which will bring the maximum protection to consumers. The plan of operation developed in the enforcement of the food and drugs act is applied to the enforcement of other acts administered by the Food and Drug Administration, with only such modifications as variations in the laws or in trade practices require.

PROCEDURE FOR CORRECTING VIOLATIONS

In applying the import sections of the various acts enforced, close inspection is maintained at ports. Products that do not meet the requirements of the acts are denied entry into the United States. In the enforcement of the acts in their application to interstate commerce, adulterated and misbranded products may be seized or persons responsible for the violations may be prosecuted, and after conviction may be fined and for repeated offenses may be imprisoned.

Seizure action, because of its quickness and effectiveness, is taken whenever practicable by the Federal food officials if questions of economic fraud or public health are involved. The criminal sections of the acts are invoked whenever necessary to bring about the correction of fraud or harmful practices. If a shipment of a food, drug, or insecticide product known to be adulterated passes out of or never reaches the jurisdiction of the Federal Government, the assistance of State or city food officials is enlisted and the powers of State laws invoked to remove quickly the offending products from the market. An office is maintained for the sole purpose of promoting cooperation among Federal, State, and city food and drug control officials.

The great majority of manufacturers put out only sound, wholesome, truthfully labeled products. They go to great effort and great expense to insure that their products may not even accidentally be contaminated. Unfortunately, however, there is always an element in every line of food and drug manufacture which will either adulterate or misbrand its products or which is unwilling to go to the expense or pains necessary to insure that its processes are in accordance with modern systems of sanitary science and its product free from accidental contamination. It is this element which makes it necessary for the Federal Government to apply drastic action in the form of seizure or criminal prosecution.

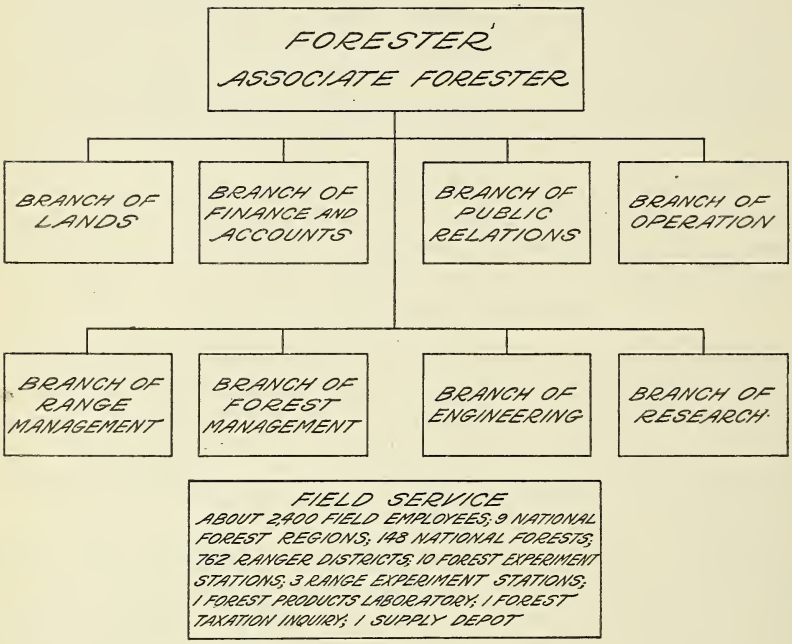
EDUCATIONAL METHODS USED

The Food and Drug Administration uses educational methods to bring about correction in the enforcement of the various acts wherever such methods will be effective, and in a large measure they are effective. To prevent violations of the acts by showing how to put out good products brings even better protection to consumers than to punish offenders after the acts have been violated.

By means of educational methods, seizure action, and prosecutions combined, the best results are obtained in regulatory work. The effective enforcement of Federal and State food and drug laws has reduced adulteration that is harmful to health. Among thousands of food samples analyzed yearly by Federal and State chemists, very rarely is a food product now found to be preserved by any of the chemical preservatives known to be harmful. Harmful contamination of packaged foods from underprocessing or other accidental causes is now extremely rare, considering the vast volume of such products annually turned out. Adulteration in food products to-day is mostly economic in character. It is intended to cheapen the article and may in no way affect its wholesomeness. These economic frauds, including various forms of misbranding of both foods and medicines, all designed to extract extra dollars from the consumer's pocketbook, are to-day the chief concern of enforcement officials.

As a result of the enforcement of the six acts administered by the Food and Drug Administration there is less adulteration and misbranding to-day in foods, drugs, insecticides, naval stores, and caustic poisons than ever before.

FOREST SERVICE



FOREST SERVICE

In its broad aspects, the responsibility of the Forest Service is the development and promulgation of measures to keep one-fourth of the Nation's land area productive, to insure a continuous supply of wood to meet the Nation's requirements, to obtain full benefit of the forests in conserving soils and waters, and to preserve the important social values of the forests.

The activities of the Forest Service may be divided into three major groups: (1) The protection and administration of the national forests, and their extension; (2) research at regional forest experiment stations, the Forest Products Laboratory, and elsewhere upon problems in forest and range management, the utilization of wood, and in supplies of and demand for forest products of all kinds; and (3) cooperation with the States in the advancement of forestry practices on State and privately owned land.

THE NATIONAL FORESTS

There are at present 148 national forests, located in 31 States and Territories and having an aggregate net area of nearly 160,000,000 acres. Of this total, approximately 153,000,000 acres or 96 per cent are located in the 11 far Western States and Alaska and are made up of public-domain lands, chiefly valuable for watershed protection and the production of forests. The remaining 7,000,000 acres are located in the Middle Western, Eastern, and Southern States. This acreage consists in part of lands reserved from the public domain and in part of purchase areas. Additional lands are being purchased in the Lake States and in the East and South as Congress appropriates money for that purpose.

The basic natural resources of the national forests—including wood, water, and range forage—are managed for continuous production, and their recreational opportunities are conserved.

The policy in administering the national forests is to provide for the maximum use consistent with the purposes for which they were created; to provide a permanent supply of timber, and protect the watersheds in which they are located. Following this principle, the national forests are open under proper regulation for a great variety of uses. For those of a commercial nature, charges are made consistent with the value of the products removed or concessions granted. The average annual receipts from the national forests for the five years 1925–2929, were approximately $5,412,761. Twenty-five per cent of the receipts is turned over to the States to be prorated to the counties containing national forests for roads and schools.

The national forests contain approximately 20 per cent of the forested area of the country and a total estimated stand of 552,000,000,000 feet of merchantable timber. Mature timber is sold from

the national forests as there is demand for it, but not in quantities in excess of the annual growth. The annual cut in recent years has averaged approximately 1,250,000,000 feet. Cutting is done under Forest Service supervision on the principle of sustained yield, whereby adequate provision is made for successive crops of timber on the same land.

In addition to assuring permanent timber resources, national forests protect the watersheds of about one-third of the water-power resources of the country and the water supplies of some 780 municipalities. They also furnish summer range for more than 7,000,000 head of livestock. Ranges are managed for continuous forage production as well as for soil conservation and watershed protection.

Millions of people visit the national forests every year for outdoor recreation, hunting, fishing, camping, hiking, and so on, and thousands of summer homes are located on them.

FORESTRY RESEARCH

To meet the requirements of the country for forest products, to conserve the æsthetic and recreational values of our forests, to maintain their beneficial effects on stream flow, and to prevent erosion, requires the development of forest management for a wide variety of climatic, topographic, soil, and economic conditions. There are now 10 regional forest experiment stations, 1 in each of the most important timber-producing regions of the country. Research at these stations aims to work out methods of cutting which will insure natural regeneration of the forest to obtain full timber crops in the shortest possible time, and to secure information upon which proper reforestation of denuded lands can be based. It also deals with the protection of forests through analyzing the damage done by fire, studying possibilities of reducing hazard, eliminating causes and predicting periods of extreme fire danger, and works out proper methods of handling forest lands to check erosion and soil washing.

The aim of forest-products research, conducted largely at the Forest Products Laboratory of the Forest Service at Madison, Wis., is to aid in making timber growing profitable through more efficient utilization, and to aid in providing the public with needed forest products. The enlargement of merchantable yields, the utilization of waste and of species now considered inferior or worthless, and the development of new uses and improved practices are involved. The determination of the chemical composition and physical structure and properties of all species is required. It is also necessary to know how these are affected and may be controlled by the conditions of growth, and how the material may be most efficiently harvested, selected, prepared, modified, adapted to service, and converted into usable by-products.

Range research is conducted at the forest experiment stations and elsewhere to determine how to use lands suitable for grazing to best advantage. The information is needed primarily for proper administration of about 90,000,000 acres of national forest land, but is ap-

plicable in part to other range lands, in public and private ownership. It is essential to learn not only how to maintain and increase range productivity for livestock grazing but also how to prevent erosion and to preserve the watershed values of these grazing lands.

Forest economic investigations deal with the economic aspects of forest production and forest-land utilization which largely determine the extent to which the results of other fields of forest research can be applied, and underlie the formulation of sound public and industrial forest policies. Among the economic investigations under way are: A nation-wide appraisal of our forest resources, of the present and potential growth, of the drain upon the forests through cutting, fire, disease, and insects, of the present and prospective needs of the Nation for forest products, and of economic relationships; an investigation of forest taxation; a study of the costs and returns, and the financial feasibility of forestry as an economic undertaking by private owners, and a study of the possibilities of forest insurance.

STATE COOPERATION

By the passage of the Clarke-McNary Act of June 7, 1924, Congress adopted a national program of forestry which provides for Federal cooperation with the several States in the protection and reforestation of State and privately owned forest lands. The act authorizes and directs the Secretary of Agriculture—

> under such conditions as he may determine to be fair and equitable in each State, to cooperate with appropriate officials of each State, and through them with private and other agencies therein, in the protection of timbered and forest-producing lands from fire.

The Forest Service is responsible under direction of the Secretary of Agriculture for the administration of this act and for securing results from Federal moneys expended. Thirty-eight States are now cooperating with the Federal Government under the fire-protection benefits of this act, and the total acreage of State and private lands under some form of organized protection against fire is in excess of 240,000,000 acres.

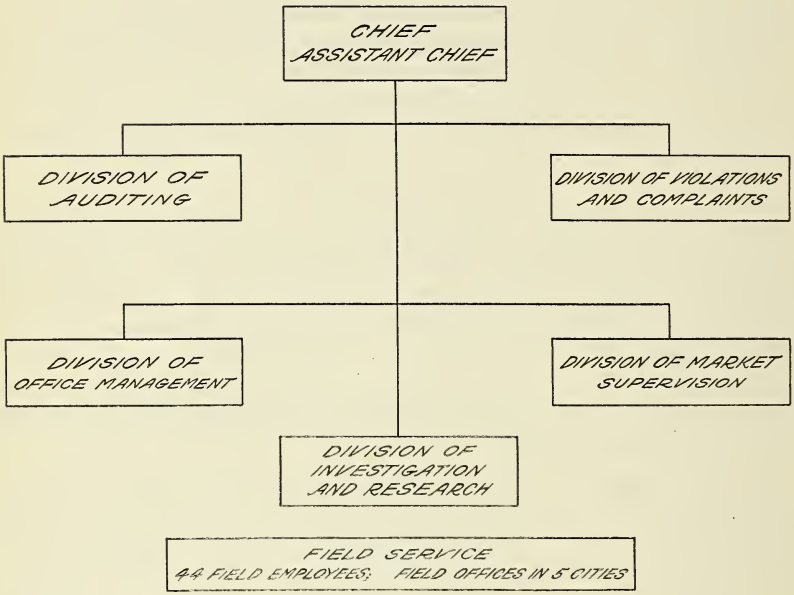
The Clarke-McNary Act also provides that the Federal Government shall cooperate with the several States in the

> procurement, production, and distribution of forest-tree seeds and plants, for the purpose of establishing windbreaks, shelter belts, and farm woodlots upon denuded or nonforested lands within such cooperating States.

The cooperating State contributes at least one-half the funds needed for this work. Thirty-nine States and two Territories are now cooperating with the Federal Government in accordance with the provisions of this section of the act, the work being done under general supervision of the Forest Service. Approximately 29,000,000 seedlings were distributed for farm planting during the year 1928. In most of the States the stock is distributed at cost.

The Federal Government and the States also cooperate under the Clarke-McNary Act in giving aid to woodland owners through extension activities.

GRAIN FUTURES ADMINISTRATION



GRAIN FUTURES ADMINISTRATION

Grain futures transactions (trading in grain for future delivery) originated in Chicago prior to the Civil War, as an outgrowth of dealing in "time contracts" involving the purchase of grain for deferred delivery. Sales of grain by time contract were recorded at Chicago as early as 1848, and gradually became important. At that time grain was transported from Chicago almost exclusively by water during the period of open navigation on the Great Lakes, and six weeks were then required for information about grain prices at Liverpool to reach Chicago. Hence considerable risk attached to the ownership of time contracts, and extended speculation developed therein. This speculation reached vast proportions during the Civil War. It was not until 1865, however, that trading in grain futures was recognized as a distinct commercial practice in the rules of the Chicago Board of Trade.

Dissatisfaction developed among producers and others as a result of erratic price fluctuations associated with the widespread trading in futures contracts. By 1884 this feeling brought about the introduction of congressional legislation to combat manipulation and market corners. The upshot was the enactment in 1921 of the future trading act. This law, designed to prevent manipulation of the Nation's grain markets, was based upon the taxing power of Congress. It was attacked in the courts and was declared unconstitutional by the Supreme Court in 1922. Then followed the enactment of the grain futures act of 1922, having the same general purpose as its predecessor, but based upon the power of Congress to regulate interstate commerce. This legislation was sustained by the Supreme Court in 1923, and its enforcement was begun by the Department of Agriculture July 1, 1923.

REQUIREMENTS OF THE ACT

The act requires that before future trading may be done on any grain exchange, the exchange must be formally designated or licensed by the Secretary of Agriculture as a "contract market." It must be located at a terminal market where grain is sold in sufficient volume and under such conditions as fairly to reflect its general value, and the differences in value between its various grades, and where an official inspection service, approved for the purpose by the Secretary of Agriculture, is available.

Further, the governing board of the exchange must provide for: (1) The making and filing of reports showing the details of all

transactions of the board or its members both in cash grain and grain futures, as may be required by the Secretary of Agriculture; (2) the prevention of dissemination by the board or any member of false or misleading information tending to affect the price of grain in interstate commerce; (3) the prevention of manipulation of prices or the cornering of grain by dealers or operators upon the board; (4) the admission of responsible farmers' cooperative associations; and (5) making effective final orders and decisions rendered by the Government incident to the violation of certain provisions of the act.

The following 13 grain exchanges have been licensed as contract markets: Board of Trade of the City of Chicago, Chicago Open Board of Trade, Minneapolis Chamber of Commerce, Duluth Board of Trade, Kansas City Board of Trade, St. Louis Merchants Exchange, Milwaukee Chamber of Commerce, Baltimore Chamber of Commerce (inactive as a futures market), Los Angeles Grain Exchange, Grain Trade Association of the San Francisco Chamber of Commerce, Seattle Grain Exchange, New York Produce Exchange (inactive as a futures market), and Portland Grain Exchange.

FUNCTIONS OF THE ADMINISTRATION

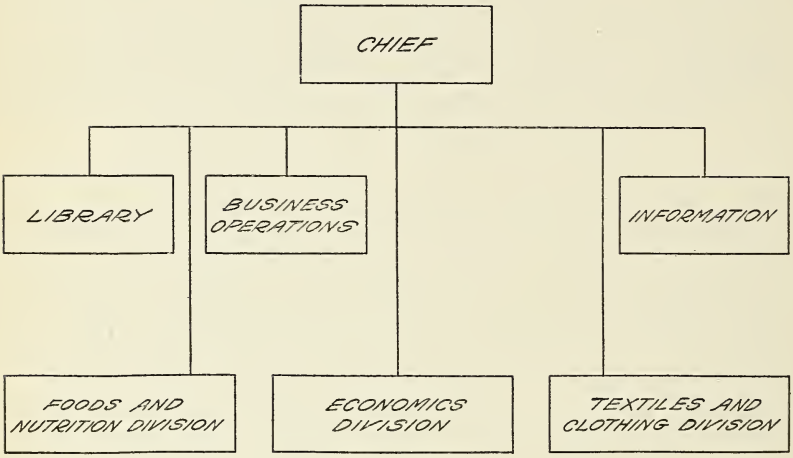
The members of each contract market are required to keep complete records of all transactions both in cash grain and grain futures. These records are subject at all times to the inspection of representatives of the Grain Futures Administration and the Department of Justice. Each clearing member of these exchanges is required also to report daily to the Grain Futures Administration: (1) The aggregate volume of both purchases and sales; (2) the aggregate of all customers' " long " and " short " accounts that are open on the books at the close of the day's business; and (3) the quantity of grain received and delivered on futures contracts. From these reports, which are filed in the field offices of the administration located at Chicago, Ill., Minneapolis, Minn., Kansas City, Mo., Seattle, Wash., and Sacramento, Calif., the administration publishes each day the total volume of trading in each future, and the total open contracts therein.

The market position of each individual trader whose account reaches a certain designated amount, varying with the different grains and different markets, is also reported daily for the confidential information of the administration. The individual accounts covered by these reports are styled " special accounts," as they frequently amount to considerable volume, and often have an important influence in price movements. The information presented by these special-account reports is helpful in lessening congestion during delivery months and in preventing corners, and affords the administration knowledge of developments that might otherwise lead to serious abuses.

The work of the Grain Futures Administration also includes the checking of any dissemination of false, misleading, or knowingly inaccurate information tending to affect the price of grain; and the general observation of the Nation's grain-marketing machinery with a view to seeing that price movements are kept free from manipulative influences.

In cooperation with other Government agencies, the administration investigates supply and demand, handling and transportation charges, and final costs to consumers of grain, grain products, and by-products.

BUREAU OF HOME ECONOMICS



BUREAU OF HOME ECONOMICS

The Bureau of Home Economics was created in 1923 to give scientific study to food, textiles, and economic problems from the home maker's point of view.

The success of agriculture requires more than efficient production and effective distribution of products raised on the farm. Supplementing these, in the 24,000,000 homes of the Nation, must be a wise utilization of foodstuffs, textile fibers, and other farm products. In such consumption the home maker is the all-important figure. To do her job intelligently she must have the same degree of scientific aid that the Government gives the farmer for the production of better crops and livestock. On the home maker rests a large responsibility in setting the standard of living.

The Bureau of Home Economics is an outgrowth of scientific work on nutrition and household food utilization begun in the department more than 40 years ago. With the development of home demonstration work and the growth of the home-economics movement through the land-grant colleges, this early work exclusively on food and dietary problems was expanded to include other phases of home economics. Not until the organization of the Bureau of Home Economics, however, was research on the consumption of agricultural products placed on an administrative level with research into production.

INTEREST IN FOOD VALUES

Recent years have seen a tremendous growth of interest in food values and diet, probably as a result in large part of the popularization of scientific findings through educational channels, and also through food advertising. The department has come to be relied on as a principal source of unbiased information. The Bureau of Home Economics is revising tables on the chemical composition of food materials which were issued by the department 30 years ago, and which are still the standard. Analyses of new foods are included, and the figures are made representative of present market grades. The bureau maintains laboratories for research on the vitamin content of foodstuffs, and cooperates with the Office of Experiment Stations in issuing comprehensive tables of the vitamin content of foods.

The department interprets basic food facts and nutrition principles in popular form, to help the consumer in choosing a well-balanced diet. As each year brings new proof of the relation between diet and health, and as the radio and other new means of trans-

mitting scientific information to the public develop, the Bureau of Home Economics expands this service. Bulletins prepared by the bureau on choosing a well-balanced yet economical diet for children and adults, building up good food habits from infancy, and preparing foods so as to conserve their food value and make them appetizing, are in great demand.

Studies on food preparation in the bureau connect directly with the department's experimental work on production, and benefit both consumer and producer. As part of a nation-wide cooperative project on the influence of various production factors on the palatability of meats, the bureau each year cooks hundreds of cuts from experimental animals for testing and final judging as to eating quality. As a by-product of this research, designed primarily to assist the livestock industry in better meat production, home methods of cooking meats are developed. Similar work is under way on potatoes, to determine the cooking quality of seedling varieties and the influence of soils and fertilizers on flavor and texture. The bureau plans to make similar tests on other well-known foodstuffs and on new foods seeking a place on the market.

UTILIZATION OF TEXTILES

Research to develop more effective utilization of clothing and textiles is carried on as an aid to production and consumption. So far, the work has centered on cotton and wool, in view of the importance of these products in American agriculture.

New ways of using standard materials in women's and children's clothing and house furnishings have been found, and in cooperation with manufacturers new fabrics have been developed for specific purposes. Osnaburg, for instance, an inexpensive fabric made of low-grade cotton and hitherto used only for industrial purposes, now retails in large quantities for use in curtains, couch covers, and other home furnishings. Its possibilities as an artistic fabric for interior decoration had not been recognized until tests were made by the Bureau of Home Economics.

Likewise, the designs originated for children's sun suits with tops of bobbinet and other open-mesh cotton fabrics, permitting the ultraviolet rays to reach the body, suggest a new use for fabrics of this type. Through the cooperation of the Cotton Textile Institute and the Wool Institute new fabrics suitable for children's protective play garments have been manufactured and put on sale.

Children's clothing designed in the bureau, besides pointing to a better utilization of textiles, harmonizes with modern child psychology and training. Each garment is designed so as to encourage self-help, active play, and good posture, and yet give good service and be as easy to make and care for as is consistent with good standards.

Studies in cooperation with the Bureaus of Plant Industry and Animal Industry determine the value of different grades of cotton

and wool in finished fabrics. Fibers of representative types are followed from the cotton field or the shearing shed, through spinning and weaving in the mill, to their use by the consumer. Thus a record is obtained of the use of certain textile fibers for certain purposes, which is turned over to the grower to guide him in producing cotton or wool and to the consumer as a help in selecting the textiles best suited to particular needs.

Starches and other finishes for textiles are studied. Cannas, dasheens, and other plant materials are tested as a possible source of starch for the sizing of textiles. Their stiffening value and other qualities are determined. Much of this is technical research, but eventually it will be applied to laundering and other processes involved in home and commercial maintenance of textiles. Popular bulletins are issued on home methods and equipment for laundering and removing stains.

FOOD-CONSUMPTION STUDIES

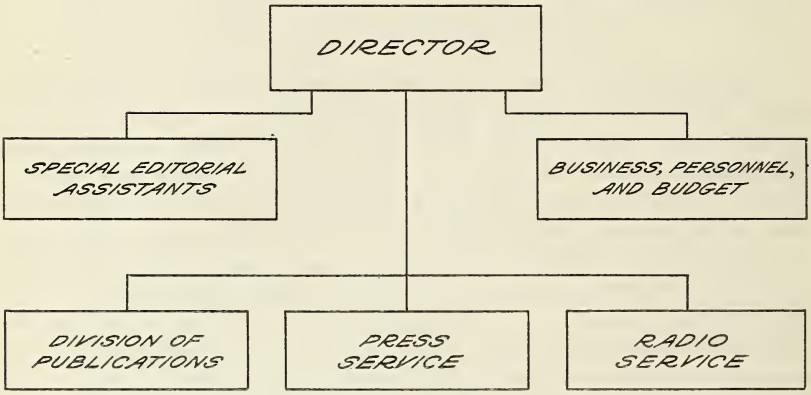
Food-consumption studies are an important branch of the bureau's work. Thousands of farm families furnished records of the kind, quantity, and cost of their food for a year. These records, when analyzed by the bureau, gave a picture of food habits on American farms. Similar records obtained from other types of families and from college dormitories, children's homes, and other institutions showed what American people eat and how their diet ranks against a standard of good nutrition. With the gathering of facts and figures on food consumption goes a critical examination of the method of food-consumption studies. New methods are sought, to save time in statistical analysis and bring greater uniformity in the results achieved by all organizations conducting research in this field.

Another type of valuable economic data is furnished by records of time spent in household tasks. Such records are kept for the bureau by a large number of farm and city home makers. They are analyzed as a basis for studies in household equipment and household management, and to locate significant differences between urban and rural home conditions.

From records of how families spend their income, likewise supplied by home makers cooperating with the bureau, recommendations are made for family budgets and methods of keeping household accounts. The expenditure of time and money in the household is studied to disclose principles which will help the home maker in obtaining satisfactory returns.

In this, as in other bureaus of the department, the results of scientific research are given directly to the public in bulletins, press and radio releases, charts, lantern slides, and exhibits. The bureau also conducts an ever-increasing correspondence with home makers and professional workers who seek information on problems falling directly in the field of home economics, but not yet covered by scientific research.

OFFICE OF INFORMATION



OFFICE OF INFORMATION

The fundamental purpose of the Office of Information is to aid in carrying out one of the two great tasks set forth in the organic act of the department—the dissemination of information made available by the research done in the department. The Extension Service and the Office of Information supplement each other in this undertaking.

The Office of Information is in no wise a publicity agency in the usual sense of that term. Its purpose is not to acquire prestige for itself nor for the department as a whole, nor to "sell" the department to the public, nor to advertise the achievements of department workers, but to make public the results of the department's manifold activities. It helps in removing the disparity between agricultural science and agricultural practice.

This office handles all major questions affecting the informational activities of the department, including editorial matters, printing, illustrating, publishing, and distributing published material. It supervises and coordinates publication activities, and press and radio information for all the bureaus and offices of the department, most of which maintain editorial offices. The 48 agricultural colleges and 53 experiment stations cooperate with the Office of Information in coordinating national and regional information. The office also cooperates with the Joint Conference on Printing, with the congressional Joint Committee on Printing, and with the Public Printer in developing effective publication methods. It has three main sections—Division of Publications, Press Service, and Radio Service.

DIVISION OF PUBLICATIONS

The department's publishing program, an outgrowth of 68 years experience, is adapted as closely as possible to the needs of farmers, research institutions, extension groups, and the general public. Publications are classified according to the needs of different groups of readers. Scientific workers demand much more detailed and precise accounts of research than do farmers and other nontechnical readers. Fundamental-research accounts are published in Technical Bulletins, Statistical Bulletins, in the periodical Public Roads, and in the Journal of Agricultural Research, primarily for technicians, teachers, and students. Semipopular material is published in Circulars and Miscellaneous Publications. The popular publications consist mainly of Farmers' Bulletins, Leaflets, and the Yearbook of Agri-

culture. A number of popular and semipopular periodicals, largely for the department's own personnel, are also issued.

The department distributes free approximately 30,000,000 publications annually.[5] In addition, the Superintendent of Documents sells about 1,000,000 copies each year at prices barely covering the cost of printing.[6] By law, Members of Congress are entitled to distribute four-fifths of the copies of Farmers' Bulletins. Persons who want Farmers' Bulletins may therefore obtain them from their Senators or Representatives.

One of the best-known department publications is the Yearbook of Agriculture, which has an annual circulation of about 400,000 copies. This volume contains the annual report of the Secretary of Agriculture to the President, numerous short articles by department specialists on recent progress in agricultural science and practice, and a large section of agricultural statistics. It is intended primarily for the farmer.

In addition to the printed publications, much material, both technical and popular, is issued in mimeographed and multigraphed form. The annual output of such material is about 52,000,000 pages.

THE PRESS SERVICE

The Press Service issues annually about 1,200 releases direct to newspapers, press associations, and correspondents. These releases disseminate spot news and timely information about the department's work. About 3,500 newspapers are reached weekly through various syndicates which use, to an increasing extent, informative feature articles on agriculture. Department workers place approximately 1,400 articles annually in outside publications. General assistance is given to special writers who visit the offices of the Press Service.

Approximately 90 per cent of the farmers in the United States take one or more farm journals, about 75 per cent take a daily newspaper, and more than 55 per cent take a weekly newspaper. Much information furnished by the department is brought to the notice of farmers through these publications. Material is specially written for their use. They appreciate the service, for it would take a good-sized reporting staff to cover the various information sources in the department if they wished to do it for themselves. Moreover, it would be costly and troublesome for reporters to settle controversial points sometimes involved in preparation of articles. Material handled through the department's Press Service is referred to all interested authorities before being released. A story about insecticides, for example, may require the approval of the chemists who study the poisons, the entomologists who study the insects, and

[5] For a complete list of available publications issued by the Department write for Miscellaneous Publication 60, and for a list of available Farmers' Bulletins write for List 1, direct to the Department of Agriculture.

[6] The Superintendent of Documents will mail, upon request, lists of agricultural publications and all other Government publications which he has for sale.

the plant scientists who study the plants on which the insects feed. Newspaper reporters could hardly be expected to go to that length in seeking accuracy.

The modern farmer is a reader and applies the information he thus obtains. Consequently publications issued by this department and by the agricultural colleges, and the material given to magazines, newspapers, and other publications, are an effective agency in agricultural progress. Though other means of communication are developing rapidly, printed matter is not losing its efficacy.

THE RADIO SERVICE

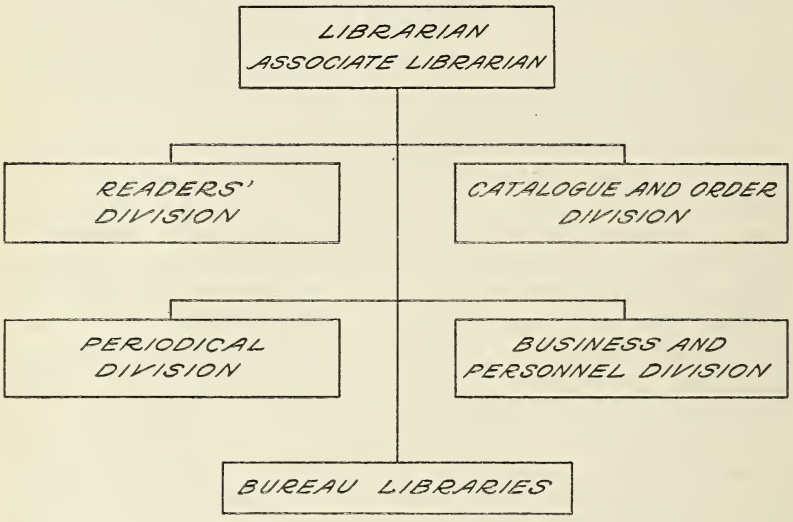
The Department of Agriculture, following the lead of a few of the agricultural colleges, established a Radio Service in 1925. Previously it had used the radio only for weather reports and market news. To-day 50 per cent of the 600 radio stations in the United States cooperate daily with the department. Some broadcast only market news and weather reports. Two hundred stations, however, carry daily educational programs also.

Two types of educational programs are issued—one in manuscript form to individual stations; the other as a chain broadcast. The manuscript programs have been issued since 1925, and exert an increasing influence toward better farming and home making. At present 180 stations broadcast the department's manuscript services, as compared with 149 in 1928—this despite the fact that the number of stations in the United States has been reduced by the Radio Commission's reallocation of wave lengths, and nearly a score of stations have dropped from the list of cooperating stations because of reductions in broadcasting time.

The 5-day-a-week manuscript services are: Farm Flashes, which give seasonal recommendations on improved practices in farming; Your Farm Reporter, dealing with major problems of the farming industry in each of five general program regions; and Housekeepers' Chat, intended primarily for home makers. In addition, the Radio Service supplies weekly programs to cooperating stations: The Primer for Town Farmers, Uncle Sam at Your Service, Chats with the Weather Man, With Uncle Sam's Naturalists, and the Farm Science Snapshots. A monthly program, reviewing the general agricultural situation, is also issued.

Farmers and others like to hear the agricultural scientists and economists themselves over the radio. The National Broadcasting Co. puts at the department's disposal five days each week a chain of 39 stations, by which means voices from Washington may be heard in all parts of the country. The chain programs take to listeners (1) important regular reports, particularly economic reports such as the monthly price-situation review, crop reports, and outlook reports, on the day of release; and (2) programs with seasonal information of farming and home making. From time to time special broadcasts are carried on nation-wide networks. These radio facilities are furnished to the department without charge.

LIBRARY


LIBRARIAN
ASSOCIATE LIBRARIAN
READERS' DIVISION
CATALOGUE AND ORDER DIVISION
PERIODICAL DIVISION
BUSINESS AND PERSONNEL DIVISION
BUREAU LIBRARIES

LIBRARY

The library of the department is as old as the department itself, for the need of a library of scientific works to facilitate the work of the department has been felt from its very beginning. The foundation of the library was laid even earlier, in the Agricultural Division of the Patent Office.

The total collections of the library, exclusive of those of the Weather Bureau, now number approximately 214,000 volumes. The periodicals received currently number approximately 3,900, and an even greater number of serials such as annual reports, proceedings, and transactions, are currently received. The day's mail brings books, periodicals, and exchanges from every civilized country and in every language in which scientific data are recorded.

In all of the activities of the department the library has a service to perform. As the offices of the department are scattered in many buildings, some of them at considerable distance from the library, it is necessary to maintain not only a main library but also branches in the various bureaus. These various bureau libraries are special collections on the subjects with which the respective bureaus deal.

On the general subject of agriculture and all of its branches, such as plant and animal industry, dairying, and veterinary science, for example, the library's collections are extensive, and include not only books, periodicals, and society publications but also what may be termed the official agricultural literature. No other collection in this country is so strong in local, State, and national official agricultural publications of the United States. Similar foreign publications are comprehensively represented.

Statistical publications relating to agriculture have been collected practically from the very beginning of the library, but in the past 15 years the literature of the broader subject of agricultural economics has rapidly increased, and in this general subject the library is now especially strong. The collection includes statistical publications relating to production, consumption, acreage, marketing, and prices of agricultural products, as well as publications on farm management, land classification and utilization, taxation and finance, marketing, warehousing, standardization and inspection, rural sociology, and agricultural history.

Although the Bureau of Plant Industry draws upon nearly every class of scientific literature, its interests are, broadly speaking, botanical, and in this field the library collections are noteworthy. They include the essential working books of systematic botany and an extensive collection of periodical and society publications relating to botany. They are rich in works on economic plants in general—the

grasses, cereals, and other crop plants; and in publications on gardening and fruit culture, on industrial plants such as textile and rubber, and on plant chemistry and physiology. Perhaps they are strongest in pathology and mycology. A somewhat unusual feature is a collection of more than 25,000 horticultural trade catalogues.

The chemistry collections contain the important up-to-date books in inorganic, physical, pharmaceutical, and food chemistry, the food laws of various countries, and an extensive collection of chemical periodicals. The collections needed by the Bureau of Biological Survey include periodicals dealing with all phases of the study of birds, mammals, reptiles, and amphibians, fur farming and fur industry, game preservation, and the importation of wild life. The collection of periodicals on conservation and the extensive collection of game laws are also worthy of special mention. The collection on entomology is one of the best working collections on the subject in the United States. It is particularly strong on the economic side. Other major collections relate to forestry and lumbering, and to roads and agricultural engineering, including irrigation and drainage, farm buildings, farm equipment, and rural sanitation. In the new Bureau of Home Economics the library is building up a collection of publications on the problems of the home, including foods, nutrition, textiles and clothing, and housing and equipment. The Weather Bureau library contains about 50,000 volumes and is the largest single collection of meteorological literature in the world.

Utility mainly determines the choice of books. Books are not purchased because of their rarity or beauty, unless they have also a scientific or historical value to the department. Nevertheless, the library contains many rare books and periodicals. Full advantage is taken of the resources of other Government libraries, particularly the Library of Congress and the Surgeon General's library. Books which are available in other libraries in Washington are not duplicated unless needed for frequent consultation.

CATALOGUES, INDEXES, AND BIBLIOGRAPHIES

The dictionary catalogue of the library, the greatest single source of information on the literature of agriculture and the related sciences, now contains over a half million cards and is a record of the book resources of the whole department with the exception of the collections of Weather Bureau. This dictionary catalogue also contains printed cards for books of interest to the department which are available in the Library of Congress and other Government libraries. The catalogue is supplemented by more detailed special indexes and biliographies. These are in large part provided by the bureau libraries.

In addition to the extensive catalogue of its collections, the Weather Bureau library is compiling an encyclopedic dictionary of meteorology. The Bureau of Plant Industry library staff maintains an extensive index which is generally referred to as the "Botanical Catalogue." It aggregates more than a quarter million entries, including

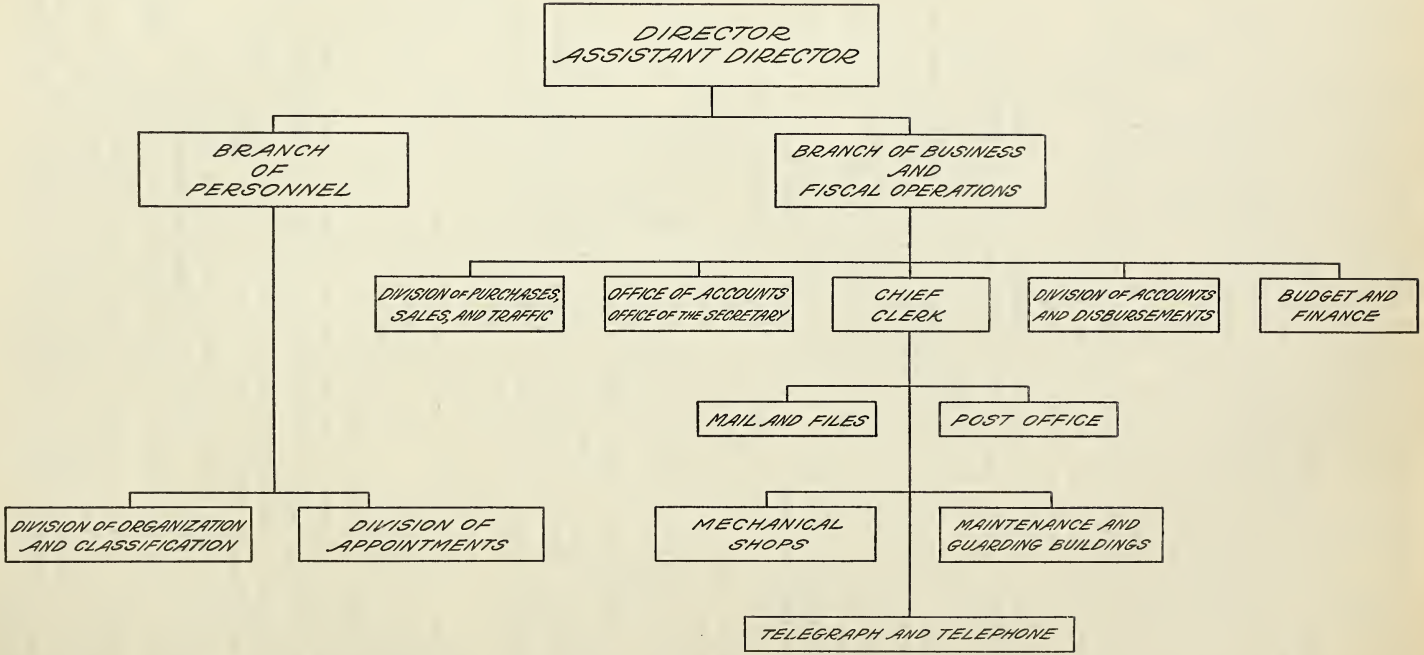
a detailed subject index to plant pathology, an index to illustrations of foreign plants, and a large catalogue of botanical literature in the widest sense. In the Bureau of Animal Industry library there is maintained an extensive card index of a quarter million cards devoted to the literature of animal diseases. The most important index prepared in the Bureau of Entomology library is the Index to the Literature of American Economic Entomology. This index has been published in three volumes at 5-year intervals, covering the period of 1905–1914, 1915–1919, and 1920–1924. The volume for 1925–1929 is in preparation. The Bureau of Agricultural Economics library, the Forest Service library, and the Bureau of Public Roads library also maintain extensive indexes on the subjects with which their respective bureaus are concerned.

Supplementing the various catalogues and indexes of the libraries are bibliographies and lists which have been prepared both by the main library and the bureau libraries. Most of these are mimeographed. The series of Bibliographical Contributions issued by the department library numbers 20 to date. In a series of Agricultural Economics Bibliographies issued by the Bureau of Agricultural Economics library, 30 numbers have been issued. In addition to the bibliographies included in these series, there are various separate bibliographies issued by the libraries of the Forest Service, the Bureau of Public Roads, and the Bureau of Home Economics.

Other types of bibliographical service furnished by the various libraries of the department are lists of current literature. In the Bureau of Agricultural Economics library the list is issued monthly and is called "Agricultural Economics Literature." The Bureau of Plant Industry library issues two biweekly lists called respectively "Botany Current Literature" and "Agronomy Current Literature." The Forest Service library issues a bimonthly list called "Forestry Current Literature," and the Bureau of Public Roads issues monthly a list called "Highways and Agricultural Engineering Current Literature." The Office of Experiment Stations library compiles various lists of the State experiment station literature and the State extension literature. The Official Record of the department contrains a weekly list of the principal accessions to the library of the department. These various current lists aid the department workers in keeping informed about new material on their various subjects. They are also being increasingly used by investigators outside the department. The Experiment Station Record serves as an index to the department library, since most of the books and periodicals abstracted in the record are contained in the library.

While the library is first of all for the benefit of the department, it is free for reference to any who wish to use it. Books needed in research work are lent to libraries and institutions in every State of the Union, particularly to the various State agricultural colleges and experiment stations. The library also aims to serve as a center of bibliographical information relating to the literature of agriculture.

OFFICE OF PERSONNEL AND BUSINESS ADMINISTRATION



OFFICE OF PERSONNEL AND BUSINESS ADMINISTRATION

The Office of Personnel and Business Administration was organized in 1925 by consolidating nine separate offices concerned with the business administration of the department. Its purpose is to eliminate confusion and waste in business procedure and to effect greater economy in the business and personnel practices of the department.

The Office of Personnel and Business Administration is divided into two major parts—the Personnel Branch and the Branch of Business and Fiscal Operations.

All the field activities of the department, as well as the work in Washington, come before this office so that their personnel and business phases may be coordinated. The office represents the department in dealing with the Civil Service Commission, the Personnel Classification Board, the Employees' Compensation Commission, the Bureau of the Budget, the General Accounting Office, the Retirement Division of the Pension Bureau, and various boards operating under the authority of the Chief Coordinator.

In personnel, administration, organization, budget, and fiscal matters, the office cooperates with bureau chiefs in effecting improvements. It deals with purchases of equipment, with the sale of unneeded materials, with the transportation problems involved in sending members of the department on journeys necessary in their official duties, with providing offices for the department's personnel, and with the care of buildings and equipment.

PERSONNEL BRANCH

In the Personnel Branch, there are a Division of Appointments and a Division of Organization and Classification. The Division of Appointments is responsible for personnel changes of the department, in so far as such changes are affected by civil service rules, by administrative and fiscal regulations, or by decisions of the Comptroller General. The division has a complete service record of approximately 25,000 employees. Its work covers appointments, promotions, demotions, resignations, removals, retirements, leave, or furloughs without pay. It assists in developing tests and examinations for applicants for positions in the department.

The Division of Organization and Classification handles requests for the classification of the positions of department employees, as

required by the salary classification act of 1923, under which a Personnel Classification Board was set up and a new system established for evaluating the duties of Government employees. For a time the Director of Personnel and Business Administration handled the classification work necessary under the new legislation. The work increased so much that a separate division, with a trained classification man in charge, was created in 1929 to deal with it.

The work of the division covers the full range of classes and salaries as defined by the salary classification act, and by amendments thereto. It investigates appeals for classification and makes recommendations to the director in regard to such appeals. It presents classification cases before the Personnel Classification Board. It passes on proposed changes in departmental organization. It investigates such proposals, considers what changes in personnel may be involved, and estimates their probable effect on departmental efficiency and economy.

Primarily the existing personnel classification system is designed to allocate positions according to the character of the work and the degree of responsibility involved. Facilitating this task, however, is not the sole function of the Division of Organization and Classification. It also studies the organization of the various bureaus, and analyzes and describes bureau functions.

Plans are now under way for the establishment of a school of instruction in personnel and classification methods. The division investigates the field activities and organizations of the department to promote a closer relationship between departmental administrative officers and the field service. Other questions falling within the scope of the division's activities include welfare and social service, the training of employees entering the Government service, and the advising and instruction of bureau personnel officers.

BRANCH OF BUSINESS AND FISCAL OPERATIONS

The Branch of Business and Fiscal Operations in the Office of Personnel and Business Administration supervises the department's finances. It assists the bureaus in drawing up estimates of their requirements and in presenting these estimates to the Bureau of the Budget and to congressional committees. It keeps track of departmental receipts and disbursements, arranges with the several bureaus for the allotment of appropriations in the expenditure of which more than one bureau is concerned, passes on proposed purchases of equipment, sees that efficient bookkeeping methods are employed, and cooperates with the bureaus in effecting economies. Some idea of the character of the work done by this branch, and also an impression of the extensive and many-sided nature of the department's functions as a whole, can be gained from a glance at the department's financial history. (See page 24.) Every appropriation made by Congress for the department's work creates new prob-

lems in financial administration. To solve the problems thus created, is the special function of the Branch of Business and Fiscal Operations.

BUILDING OCCUPIED BY DEPARTMENT

In the District of Columbia the department occupies more than 40 buildings and parts of buildings, some owned by the Government and others rented. The principal one is a white marble building of five stories on the south side of the Mall, recently completed by the construction of an administration unit connecting the east and west wings. The entire building has a north frontage of 750 feet. The construction of an extensible building south of the Administration Building will be started shortly. This will provide approximately 320,000 square feet of floor space, and will house the department library, the Forest Service, the Bureau of Public Roads, the Bureau of Home Economics, the Bureau of Entomology, and the Bureau of Biological Survey, and other important bureaus. It will be built so that it can be enlarged by the construction of long wings east and west, which will eventually house all branches of the department not otherwise provided for.

Outside but near the District of Columbia, the department operates the Arlington Experiment Farm in Virginia, principally used for the experimental work of the Bureau of Plant Industry, two experimental farms at Beltsville, Md., devoted to experimental work in animal husbandry and dairying, a bee-culture station at Somerset, Md., and a plant-quarantine and foreign plant introduction station at Bell, Md. A livestock-disease experiment station is located at Bethesda, Md. A new national arboretum at Mount Hamilton, in the District of Columbia, is in process of development.

WHERE THE PERSONNEL IS STATIONED

Roughly, a fifth of the department's personnel of approximately 25,000 persons is stationed in and near Washington.[7] The others are in the field. The organization touches every State in the Union and has branches in Alaska, Hawaii, Porto Rico, Guam, and the Virgin Islands, and foreign countries. In 1929 the department had 695 field stations, large and small, not including ranger stations of the

[7] A list of technical workers in the U. S. Department of Agriculture may be purchased from the Superintendent of Documents for 15 cents per copy. It is U. S. Dept. Agr. Miscellaneous Publication 93.

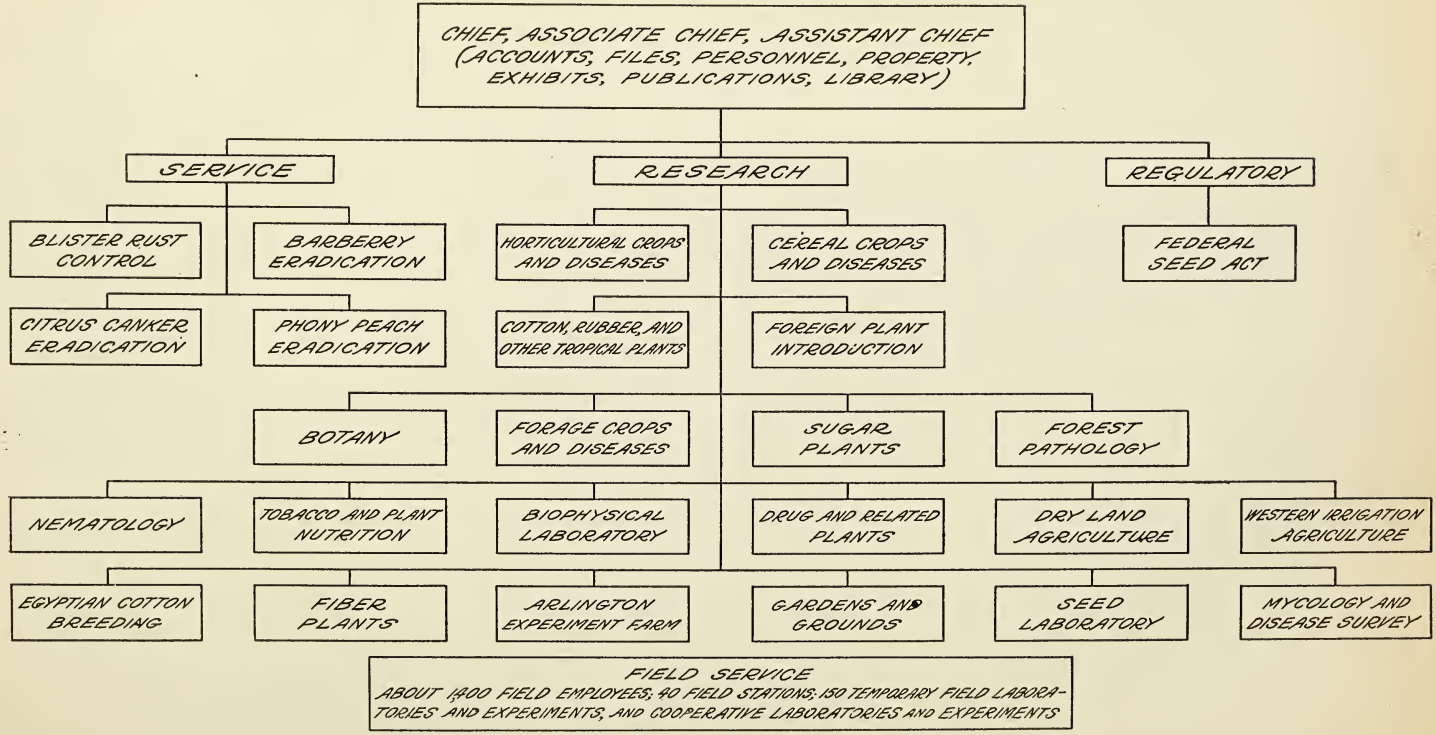
Forest Service or offices of county agents of the extension service. A list of these locations, by States, follows:

Alabama	5	Michigan	18	South Dakota	13
Arizona	15	Minnesota	11	Tennessee	10
Arkansas	8	Mississippi	11	Texas	42
California	55	Missouri	12	Utah	12
Colorado	18	Montana	19	Vermont	13
Connecticut	8	Nebraska	7	Virginia	15
Delaware	1	Nevada	7	Washington	24
Florida	23	New Hampshire	6	West Virginia	7
Georgia	12	New Jersey	20	Wisconsin	8
Idaho	25	New Mexico	13	Wyoming	8
Illinois	12	New York	20	Alaska	9
Indiana	14	North Carolina	13	Hawaii	1
Iowa	12	North Dakota	19	Porto Rico	5
Kansas	14	Ohio	15	Virgin Islands	1
Kentucky	5	Oklahoma	6	London	1
Louisiana	13	Oregon	19		
Maine	10	Pennsylvania	18	Total	695
Maryland	12	Rhode Island	5		
Massachusetts	16	South Carolina	9		

LABORATORY FACILITIES AND EQUIPMENT

Of the 19 major subdivisions of the department, 13 use laboratory facilities and equipment of one kind or another, ranging from delicate devices for studying the effect of short wave lengths of light on plant growth to heavy machinery for highway construction. Small balloons are employed for studying the course of winds in the upper reaches of the air, and soil augers for bringing up samples of soil for study and classification. Mechanical milkers are used in dairy studies. A complete milling outfit is used in testing the bread-making qualities of wheats. The research of the chemist, the biologist, the bacteriologist, the entomologist, requires not only standard apparatus and equipment but many devices invented by department specialists. The department's equipment also includes a fleet of trucks, a completely equipped mechanical shop, exhibits prepared for display at fairs, motor boats, a complete plant for making motion pictures, and much other scientific and mechanical equipment.

BUREAU OF PLANT INDUSTRY



BUREAU OF PLANT INDUSTRY

The Bureau of Plant Industry is mainly occupied with problems of plant production. It strives to lessen the waste of effort, time, and money that results from ignorance or disregard of the biological facts and processes involved in plant growth and plant utilization. National progress in agriculture, through intelligent appreciation of existing facts and through the development of new ideas directly or indirectly related to crop production and plant growth, has been the underlying purpose of the bureau. Some of the bureau's activities have accordingly dealt more with general agricultural efficiency than with crop handling; for example, the organization of farm-management studies (now part of the work of the Bureau of Agricultural Economics), the employment of local agricultural advisers or farm demonstration agents (now enlarged into the Smith-Lever extension work, the States and the Federal Government cooperating), studies of rural organization and systems of agricultural marketing (later incorporated in the Bureau of Markets and now part of the work of the Bureau of Agricultural Economics). All these began in offices or branches of the Bureau of Plant Industry and developed until their size or relation to other branches of the department rendered their transfer expedient.

CONTRIBUTIONS TO ECONOMIC PROGRESS

The most numerous and perhaps the most significant of the bureau's contributions toward the Nation's economic progress, however, have been the establishment of new industries, the introduction of new plants, the development of new methods of plant culture or handling, or other new ideas involving plant production or plant science. The bureau's work also includes crop improvement by breeding and selection, experimentation in culture and rotation methods adapted to irrigation, dry-land, and other systems of agriculture; investigations in the handling, storing, shipping, and processing of plants or plant products, and the control of plant diseases. Widely varied research is conducted in the fields of agronomy, horticulture, physiology, biochemics, and technology.

NEW PLANTS

Plant material for use in breeding work is being secured not only through study of that already in this country, but also in special cases through foreign exploration and study of the crops in the

regions where they are native and are obtainable in more primitive form than elsewhere. The bringing together of promising plants from other parts of the world is in fact one of the very important functions of the bureau. Through this means the basis of our agriculture is steadily being broadened both by securing improved types of plants suited to immediate adoption for quantity production and through affording the necessary material for use of the plant breeders of the country. The important Egyptian cotton industry of the Salt River Valley of Arizona is a direct result of such work. The rapidly growing date production of the Coachella Valley, Calif., is another illustration, while many of our leading varieties of cotton, wheat, oats, soybeans, sorghums, grasses, and other staple crops trace directly or indirectly to this type of work.

Among the first of the major activities of the bureau was the study of foreign cereals and the selection and introduction of certain important varieties for trial in the United States. The first introduction of a new grain upon a large scale was the establishment of the durum varieties of wheat which are adapted to certain of the more severe climates of the United States where the varieties of wheat previously grown were unsuited. Hazards in wheat production under dry-land conditions have been much reduced by the introduction of hard red winter wheats from Russia and by the development therefrom of improved pure lines or hybrids such as Kanred, Oro, Regal, and Newturk.

COTTON-PRODUCTION STUDIES

As a result of intensive studies of cotton-production problems in the United States by specialists of the Bureau of Plant Industry, superior varieties of cotton have been bred, while others have been discovered and introduced from abroad and developed in this country, including such varieties as Acala, Lone Star, Columbia, Trice, Foster, Express, Durango, Meade, and Pima. The Acala cotton, a superior upland variety producing a premium staple, was discovered in 1906 in a remote region of southern Mexico by an expedition sent out by this bureau. It was introduced, selected, and established in cultivation in the United States. With the exception of a small acreage of the Pima Egyptian cotton in the Salt River Valley of Arizona, practically the entire irrigated cotton area of western Texas, New Mexico, Arizona, and California is now producing Acala cotton. The Acala cotton is also being grown on hundreds of thousands of acres in the natural rainfall regions of Texas, Oklahoma, and Arkansas.

FUNDAMENTAL RESEARCH

In common with other agricultural research institutions in this country and abroad, it has been the experience of the Bureau of

Plant Industry since its inception that the problems eventually of the greatest value to agriculture are those dealing with the most fundamental research. The outstanding example of projects of this character at the present time is the biological influence of light, as indicated by the determinative effect on plant growth of different lengths of day, upon different species and varieties of plants. The importance of this relationship is shown by the revolutionary discovery that the maximum length of the summer day is the determining factor in the distribution of many species of wild plants in the temperate and tropical regions. This information is now being utilized in more satisfactory planning of the experimental regions for different new cultivated plant varieties. The accurate, prompt placing of new varieties of small fruits such as strawberries, the more satisfactory control of the blooming periods with resultant improvement in the opportunities for breeding and selection of new varieties, and the selection of areas for seed production of certain crops are a few of the immediately practical advantages dependent on the discovery of the length of day reaction.

Increased yield per plant or per unit of area has not usually been a primary objective in fruit breeding, but, rather, the development of varieties which are superior in some particular to existing sorts, or are better suited for certain purposes, or which will extend the range of adaptability of the fruit to other regions. Thus the Van Fleet raspberry, developed by breeding, adds to the list of raspberry varieties a new sort that not only is normally much more productive than the standard sorts but is adapted for home use to a large region south of that in which ordinary red raspberry varieties are successful and which extends into northern Florida.

DEVELOPMENT OF DISEASE-RESISTANT VARIETIES

The control of plant diseases by the development of protective cultural practices, new spray materials, or other methods, especially when major crops were involved, has always been one of the principal phases of the bureau's activities. Some plant diseases are most effectively fought through the discovery or breeding of varieties immune or resistant to them. To the extent that it is possible to combine disease resistance with the special qualities for which the plant is grown, this is the obviously sound line of procedure, for the protection of susceptible plants against parasitic organisms through sprays, dusts, or other methods obviously increases the cost of their production. To forward this work, the Bureau of Plant Industry has under way a number of plant-breeding projects which aim to produce crop plants possessing desirable qualities for growth in particular regions, in combination with resistance to the diseases that have been found most troublesome and expensive to control. Among such may be mentioned the breeding of pears resistant to pear blight;

chestnuts resistant to blight; peaches resistant to brown rot; tomatoes resistant to wilt; wheat resistant to rosette, rust, and other diseases; flax resistant to wilt; sugar beets resistant to curly top; and sugarcane resistant to mosaic. This last-mentioned disease, during the last decade, has attracted world-wide attention and has been the subject of investigations in 22 cane-producing countries. The bureau has introduced into the United States new varieties of sugarcane that have proved to be resistant to the mosaic, and the cultivation of these varieties has rehabilitated the sugarcane industry in Louisiana. Louisiana's 1929 sugarcane area was estimated at 225,000 acres, which compares favorably with the acreages grown before the appearance of mosaic disease in 1919. Thus, in a few years a threatened industry has been reestablished upon a sound agricultural and economic basis through scientific knowledge.

COOPERATIVE PLANT DISEASE CONTROL

Campaigns to control or eradicate certain plant diseases are conducted by the bureau in cooperation with the authorities of certain States.

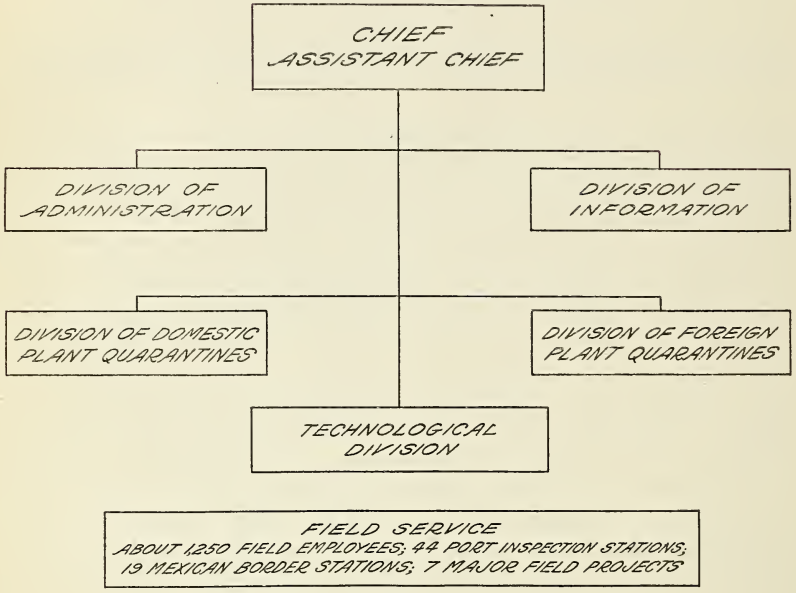
In cooperation with Florida, Alabama, Mississippi, Louisiana, and Texas a campaign is conducted for the eradication of citrus canker, a bacterial disease of citrus fruits and trees, by the thorough inspection of nurseries and citrus groves, the treatment of infected soil with formalin, the protective spraying of groves exposed to infection, and the destruction of diseased trees. As a result, the disease has been practically eliminated, but scattered infections still occur sporadically.

Campaigns for the suppression and control of white-pine blister rust are carried on in cooperation with State organizations, counties, towns, and individual land owners. The eradication of Ribes, which serve as carriers of the disease, the inspection of nursery stock likely to carry the disease to uninfected regions, and other control methods are used. The Eastern and Lake States cooperating are Connecticut, Maine, Massachusetts, Michigan, Minnesota, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, Vermont, and Wisconsin. The Western States cooperating are California, Idaho, Montana, Oregon, and Washington.

Thirteen North Central wheat-producing States (Colorado, Illinois, Indiana, Iowa, Michigan, Minnesota, Montana, Nebraska, North Dakota, Ohio, South Dakota, Wisconsin, and Wyoming) cooperate in campaigns to eradicate the common barberry, an intermediate host of black stem rust of cereals.

In July, 1929, the bureau, in cooperation with the Georgia State Board of Entomology, began a campaign for the eradication of the phony disease of peaches, an infectious condition of the root system resulting in abnormally small and poorly flavored fruit.

PLANT QUARANTINE AND CONTROL ADMINISTRATION



PLANT QUARANTINE AND CONTROL ADMINISTRATION

The Plant Quarantine and Control Administration is responsible for the enforcement of quarantines or regulations promulgated to prevent the entry into or dissemination within of dangerous plant pests new to or not widely distributed within the United States. It is also responsible for carrying on, in cooperation with the States, necessary work to prevent the spread or to eradicate pests that may have gained local foothold. It has been estimated that farm fruit, and other pests introduced from abroad cost the United States more than a billion dollars a year. About two hours of every days' work on the farm or in the garden and orchard go to feed these uninvited guests.

To accomplish these objects various laws have been enacted providing for the restriction or the regulation of movement of products likely to carry pests. Four acts of Congress make provision for quarantine or other regulatory action. They are: The Federal plant quarantine act of 1912, the act providing for Mexican border inspection and control service, the insect-pest act of 1905, and the terminal inspection act of 1915 (in cooperation with the Post Office Department).

In addition to these duties the administration is responsible for the enforcement of the export certification act. This act, as an aid to exporters, authorizes the issuance of certificates to meet the sanitary requirements of foreign countries, and provides for inspection and certification as to freedom from injurious insect pests or plant diseases of fresh fruits and vegetables, plants, etc., intended for export.

QUARANTINES AGAINST DOMESTIC PLANTS

Under the plant quarantine act 22 quarantines and restrictive orders prohibiting or regulating the entry of foreign plants and plant products are now enforced. These are intended to exclude injurious pests which either do not occur in the United States or have at present a limited distribution. Among the pests (insects and plant diseases) are citrus canker, white-pine blister rust, potato wart, bamboo smut, flag smut of wheat, downy mildew and leaf smut of rice, apple cankers and rusts, pink bollworm of cotton, banana weevils, sweetpotato and yam weevils, European corn borer, Mediterranean and other fruit flies, brown-tail moth, gypsy moth, oriental fruit moth, sorrel cutworm, European lackey moth, gold-tail moth, citrus black fly, and others.

Provision is made for the entry under permit of certain plants, cereals, fruits, vegetables, cotton, burlap, and so on, believed to carry a negligible pest risk, at ports designated in the permits, subject to inspection and, if necessary, disinfection. Plants entered under special permit—i. e., plants imported for propagation, experimental, educational, or scientific purposes, and not for immediate or ultimate sale—are examined at Washington and subsequently reexamined in the field, by agreement with the growers. All other plants and all plant products imported under permit are inspected by inspectors or collaborators of the Plant Quarantine and Control Administration at the port of first arrival or entry.

In an effort to prevent the entry of prohibited plants and plant products, the Plant Quarantine and Control Administration representatives stationed at the more important ports of entry, in addition to enforcing the entry requirements on commercial importations, are charged, in cooperation with the Treasury and Post Office Departments, with the inspection of passengers' baggage, crews' quarters, ships' stores, and foreign parcel-post packages. Passengers' baggage arriving from foreign countries by airplane is similarly inspected.

MEXICAN BORDER ACT

A few years after the passage of the plant quarantine act, a severe outbreak of the pink bollworm of cotton, perhaps the worst pest of that important plant, was discovered in the so-called Laguna region of Mexico. The grave danger of the entry of this insect into the United States with railway cars, freight, express, baggage, and other materials from Mexico, was at once recognized. As the provisions of the plant quarantine act did not fully meet this situation, the matter was presented to Congress with a request for additional authority. The outcome was the inclusion of the so-called Mexican border act in the Department of Agriculture appropriation act for the fiscal year 1918, and its repetition each year thereafter. This act supplements the plant quarantine act of 1912 by giving additional powers with respect to the control of the movement of railway cars and other carriers entering the United States from Mexico. As a condition of entry, all freight cars are inspected in the freight yards of the Mexican town opposite the American port of entry, and as an additional precaution such cars are fumigated on crossing the border.

This service also enforces all quarantines and restrictions which relate to the entry of Mexican plants, fruits, vegetables, cereals, cottonseed cake, and other products. Inspectors are stationed at the more important points on the Mexican border.

QUARANTINES AGAINST DOMESTIC PLANTS

There are now enforced 22 domestic quarantines controlling the interstate movement of plants and plant products, and of certain other materials likely to carry plant pests. Fourteen of these quar-

antines relate largely to shipments within the continental United States. Eight are confined to movements between Hawaii or Porto Rico and the mainland.

The plant quarantines relating to the continent are intended to prevent the spread within the United States, and, in certain instances, to effect the eradication, of plant and forest enemies which have recently reached this country and have limited distribution here. Examples are the gipsy moth, the brown-tail moth, the satin moth, the pink bollworm of cotton, the Mediterranean fruit fly, the Mexican fruit worm, the Japanese beetle, the European corn borer, the date-palm scale, and certain plant diseases such as white-pine blister rust, black stem rust of wheat and other cereals, and the phony peach disease.

The Federal quarantines have been very effective. No instance is known in which an insect pest of strictly local distribution has been established in a new area by the transportation of articles certified by the United States Department of Agriculture as free from infestation. The records of the Parlatoria scale on date palms, the gipsy and brown-tail moths, the Thurberia weevil, and the Mexican fruit worm, are notable in this respect. These insects depend for transportation to new localities to a large extent on the carriage of infested products, and quarantines are especially effective in regulating their movement.

Certain types of pests and diseases, however, have means of spreading that can not as yet be controlled. The object of establishing domestic plant quarantines with respect to the movement of such pests as the European corn borer, the Japanese beetle, and white-pine blister rust is to retard their spread and to prevent the establishment of new centers of infestation. It is possible (1) to investigate methods of preventing injury from the pests, (2) to inform the public about control measures and in certain cases initiate such measures before a pest arrives, and (3) to introduce parasites if the pest is an insect, or to develop resistant varieties or adopt sanitation measures if the pest is a plant disease.

ACTION BY STATE AUTHORITY

Eradication measures against certain pests that are the subject of domestic plant quarantines are undertaken by the Federal Government in cooperation with and under the direct authority of the States concerned. Such efforts have been successful in the eradication of the pink bollworm of cotton in an extensive area involving a number of counties in the Trinity Bay region of Texas, and several adjoining parishes in southwestern Louisiana, as well as a number of isolated local outbreaks in other parts of the same States; in stamping out gipsy-moth infestations in Cleveland, Ohio, and in western New York; in the approaching total eradication of an extensive infestation of this pest in northern New Jersey; and in the eradi-

cation of three separate introductions of the Mexican fruit worm in the lower Rio Grande Valley of Texas in 1927 and 1929.

The export certification act provides for the inspection and certification of fresh fruits, vegetables, seeds, and nursery stock and other plants for propagation when offered for export to meet the sanitary requirements of foreign countries. Inspectors are stationed at the more important ports of export.

The insect pest act of 1905 is enforced by inspectors stationed at the various ports of entry in cooperation with officials of the Treasury and Post Office Departments. It prohibits the importation or interstate transportation of insect pests and the use of the United States mails for that purpose, except under regulations prescribed by the Secretary of Agriculture.

The terminal inspection act of 1915, enforced in cooperation with the Post Office Department, provides under certain conditions for the inspection at destination of plants and plant products transmitted through the mails. California, Arizona, Montana, Florida, Washington, Arkansas, District of Columbia, Mississippi, the Territory of Hawaii, Utah, Oregon, Georgia, Idaho, Oklahoma, and Wyoming, in the order named, have availed themselves of the provisions of this act. While this inspection is conducted entirely at the cost of the States concerned, it results in the detection of numerous uncertified or prohibited shipments of articles mailed in violation of Federal domestic-plant quarantines. Senders of such parcels are usually ignorant of the quarantine restrictions. The terminal inspection is thus of great value in the enforcement of these quarantines.

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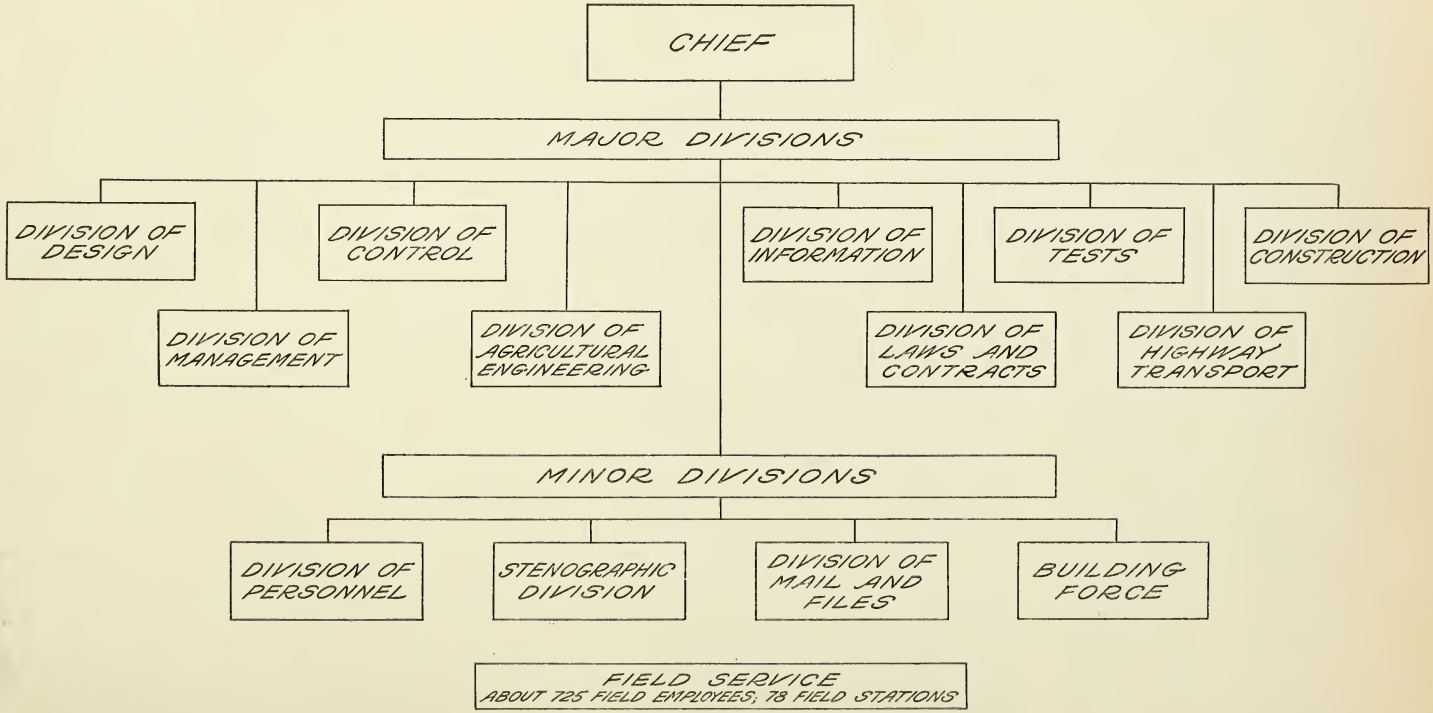
BUREAU OF PUBLIC ROADS



BUREAU OF PUBLIC ROADS

The most important work of the Bureau of Public Roads is the supervision of the cooperative construction of roads by the States and the Federal Government. This work is carried on under the Federal-aid road act of 1916 as amended by the Federal highway act of 1921 and other amendments. In this work and the closely related work of improving the main roads of the national forests, the bureau supervises an annual program of road construction involving upwards of 8,000 miles.

The bureau is also an agency of highway research. Results of its investigations, conducted independently and in cooperation with State highway departments, universities, and engineering experiment stations, are applied directly for the improvement of its own large construction operations. They are applied also on thousands of miles of other road work. The improvements in road design and in the quality of highway materials made possible by the bureau's researches are of direct benefit to all classes of road users.

Through its Division of Agricultural Engineering it conducts research directed toward the solution of the numerous engineering problems of agriculture, particularly those associated with the irrigation and drainage of farm lands, the design of farm structures, and the application of power to farming operations.

CREATED IN 1893

Under the name of the Office of Road Inquiry, the bureau was created in 1893 by the Secretary of Agriculture to carry out an act of Congress that appropriated $10,000 to enable the Secretary

> to make inquiries in regard to the systems of road management throughout the United States, to make investigations in regard to the best methods of road making, to prepare publications on this subject suitable for distribution, and to enable him to assist the agricultural colleges and experiment stations in disseminating information on this subject * * *.

From the date of its creation until 1912, the bureau's functions were those of investigation and education only. During this period, the bureau and a small but growing group of pioneer State highway departments redeemed the processes of road building from the depths of futility into which they had fallen in nearly a century of unintelligent direction, and laid the foundations of modern scientific highway construction.

The post office appropriation act for the fiscal year 1913 launched the bureau upon a new career of responsible road building. The act provided an appropriation of $500,000 to be expended by the Secre-

tary of Agriculture in cooperation with the Postmaster General for the improvement of post roads to be selected by them.

This initial experience in the administration of large construction expenditures was of great value to the bureau when, as a result of the passage of the Federal-aid road act, it was called upon to cooperate with the highway departments of the several States in a larger program.

FEDERAL-AID ROAD CONSTRUCTION

In recent years funds have been provided for this work at the rate of $75,000,000 a year. For the fiscal years 1931, 1932, and 1933, the amount has been increased to $125,000,000 annually. These funds are apportioned among the States and the Territory of Hawaii in proportion to population, area, and mileage of post roads, and are available for use only on the Federal-aid system which has been designated jointly by the States and the Federal Government. The State highway departments initiate projects, prepare plans, let contracts, and supervise construction, all subject to the approval of the Federal Government.

Federal participation is, in general, limited to 50 per cent of the cost of construction and not to exceed $15,000 per mile. The Government does not contribute to the maintenance of the roads built, but each State pledges itself to maintain them. The bureau by regular inspections directs attention to needed repairs. If these repairs are not made by the State in a stipulated period, the bureau is authorized to make them at the expense of the State.

The bureau administers this work from Washington through 11 district offices. Seven of these report directly to Washington and four to regional headquarters at San Francisco. Branch offices are maintained in most States.

Due to variations in available materials, climate, and traffic requirements, it is not practicable to adopt standard types of construction. Types ranging from graded earth to the highest types of surface are approved, the principal requirement being that the type selected shall be adequate for the conditions to be met.

The Federal-aid system, which includes the main interstate and intrastate routes of the Nation, consists of 188,857 miles. On June 30, 1929, 78,096 miles had been completed with Federal aid. Considerable work has been done on the system without Federal aid, and it is estimated that it is now about 90 per cent initially improved. However, much of the present construction needs to be further improved to make it adequate for traffic requirements.

The bureau also has charge of the construction of roads in the national forests. The forest-highway system includes 14,165 miles of road, intended to make the national forests accessible to tourists, to develop their natural resources, to furnish fire protection, and to afford connecting links on the through highway routes. On June 30, 1929, 4,091 miles of such highways had been completed.

Closely allied with the work in the national forests is work carried on by the bureau under agreement with the National Park Service of the Department of the Interior. The bureau acts as the engineering agency of the Park Service in the survey and construction of important highways in the great national playgrounds.

HIGHWAY RESEARCH

In the earlier years the bureau's studies were undertaken only that it might be fitted to teach others how to build and maintain, and how to administer and finance roads. Now its studies are usually suggested by the problems it encounters in its constructive work, and are undertaken primarily to determine its own policies. Nevertheless, the fact that it is cooperating with every State highway department in solving problems common to all these agencies gives to its researches perhaps a more direct practical significance and effect than they had when its rôle was that of the teacher only. The highway researches of the bureau are of three general classes, each class the function of a separate division of the organization.

Physical problems involving the characteristics of road materials and their behavior in the road, separately and in combination, and problems associated with the design of the road structure so as to make it resistant to traffic and climate, are investigated by the Division of Tests.

The Division of Highway Transport studies the road as a transportation facility and deals with all problems of finance and economics that bear upon the cost of roads to the public and the return to users and general public in the form of reduced vehicular operating costs.

The economic problems involved in the construction and maintenance of roads and the problems that have to do with the efficiency of construction processes and the output of construction plants and forces are the concern of the Division of Management.

In its investigations, the bureau uses intensive laboratory analyses and tests and makes extensive experiments and observations. The latter involve large sections of specially constructed test roads, actual roads in all parts of the country, and the entire road systems of certain States and counties.

The bureau has laboratories for routine testing at Washington and laboratories for experimental purposes at the experiment farm of the Department of Agriculture at Arlington, Va. It also has at Arlington a large outdoor testing ground where road surfaces of various kinds are tested under controlled traffic, and the effects of climatic and vehicular forces are investigated. Much subgrade soil investigation is done at this testing ground.

METHODS OF INVESTIGATION ILLUSTRATED

Realizing the economies that would result if, in the construction of roads, the engineers had more knowledge of the probable behavior of the wide range of natural soils upon which the surfaces

and pavements are laid, the bureau is studying this problem intensively.

It makes careful studies in all parts of the United States of road failures to which an adverse subgrade condition may have contributed. The conditions of climate, location, and drainage are noted, and samples of the subgrade soil taken for analysis.

At Arlington, work is in progress looking to the development of simple tests which may be applied to different soils to identify their characteristics and probable behavior under various climatic conditions. This work includes a study of the effects of the various elementary soil constituents on the behavior of composite soils in which they are present in varying amounts.

Samples of subgrade soil taken in the investigation of road failures are subjected to tests at the laboratory. The results are studied in relation to the known conditions of the soil in the road, in an effort to determine the exact cause of failure.

As knowledge of the habits and native character of soils is acquired, knowledge increases also in regard to things that may be done to correct unfavorable soils, or to alter the surrounding conditions so as to prevent failures similar to those that have been observed.

Other investigations by the bureau are similarly inspired and prosecuted. In large measure the work is conducted out of doors, on actual roads or large experimental sections. No other Government agency studies the same physical and economic phenomena, and the bureau avoids any work which can be more advantageously done by other Government agencies.

AGRICULTURAL ENGINEERING

The work of the Division of Agricultural Engineering is chiefly research directed toward solving the engineering problems of agriculture. Most of the work is done in cooperation with other bureaus and with State agricultural experiment stations. Considerable service of a consulting nature is rendered to the other bureaus of the department in connection with problems that involve engineering. Five distinct classes of work are dealt with by the Division of Agricultural Engineering—irrigation, drainage, mechanical farm equipment, farm structures and appurtenances, and farm-land development.

Work in irrigation includes studies of the measurement, distribution, and utilization of water for irrigation, and the organization, operation, and maintenance of irrigation districts. The investigations are directed chiefly toward securing the best possible use of the limited water supply available for irrigation in the arid West. They deal with the water requirements of plants, the conserving of off-season rainfall, the best methods of bringing water to the plants, and the prevention of losses of water. They include also the development of the best types of apparatus for measuring

irrigation water, the determination of the characteristics of flow in irrigation conduits, and study of the best methods of maintaining the flow. Certain engineering-economic studies are conducted to develop the best procedure for irrigation organization. Related to the subject of applying water to the soil is that of affording necessary drainage to prevent water-logging of the land, and to reclaim areas damaged by surplus water. Some studies are also under way in connection with irrigation as practiced in the humid areas of eastern United States, particularly as regards the use of municipal and institutional sewage for irrigation.

DRAINAGE PROBLEMS

The primary purpose of the drainage investigations is to develop fundamental facts which when applied tend to result in more effective and more economical practice in the draining of agricultural land, and in preventing and correcting the disastrous action of soil erosion. The quantity of water (run-off) that must be provided for by drains to accomplish satisfactory drainage is one of the important lines of research. Other lines of inquiry deal with methods and equipment for securing drainage by pumping, the effects of soil acids and alkalies on draintile, the laws governing the flow of water in various types of drainage channels under different conditions, the drainage characteristics of soils, the prevention of soil erosion, and the reclaiming of eroded lands. The erosion studies are provided for under a special appropriation and are conducted in cooperation with the Bureau of Chemistry and Soils and certain State agencies. They seek means of preventing the tremendous losses of topsoil now taking place on the agricultural lands of the United States in the form of surface erosion and gullying.

FARM-MACHINERY STUDIES

Mechanical farm-equipment investigations are under way to improve existing farm machinery, and to develop new machinery to meet specific needs. Chief among these studies are those relating to the control of the European corn borer by mechanical means. Proper equipment and tillage operations afford the most practical means of corn-borer control. Special equipment or new attachments to existing equipment are necessary, however, as well as certain changes in the operations of the farmer in the borer-infested areas. Effort is made to anticipate the spread of the borer into new areas by the development of such equipment as will enable farmers to meet the problem.

Another class of project under way is typified by investigations conducted to improve the mechanical distribution of fertilizers. These studies deal with the requirements of specific crops. A study with reference to cotton is in progress in cooperation with the Bureau of Chemistry and Soils and certain outside agencies. The care and use of the combined harvester-thresher have been studied

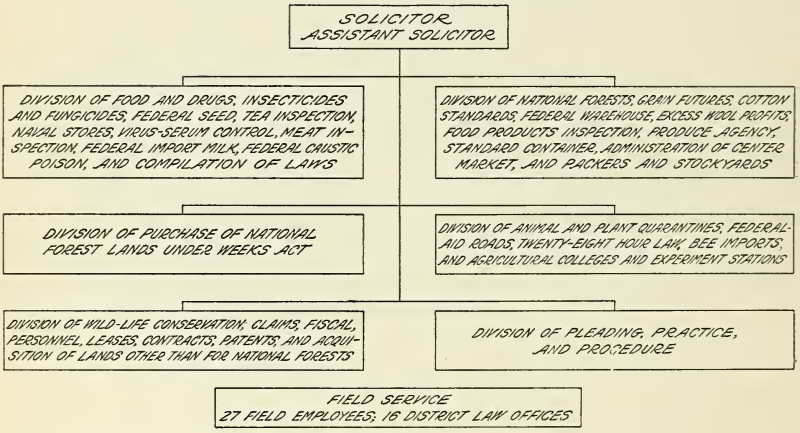
by the bureau for several years, in cooperation with other bureaus of the department and with State agencies. The development of equipment for the drying of seed cotton has been under investigation for several years, and equipment has been devised which is believed to be practical. An exhaustive experimental study of cotton-ginning equipment and of ginning processes has been started.

FARM STRUCTURES

The subject of farm structures includes the farm home and its heating, lighting, sewerage, and water supply, and other structures of the farmstead such as barns, poultry houses, and hog houses. In the same field of study are matters of ventilation and interior temperature control. The storage of grain on the farm, the structural requirements of fruit and vegetable storage places, and the facilities for transporting perishable products are important subjects of research in the Division of Agricultural Engineering. Plans are under way to develop a program of farm-structures research by cooperation with the State agricultural experiment stations.

One obstacle to the wider use of modern machinery in American agriculture is the fact that in some sections fields are small and irregularly shaped and frequently contain obstructions such as stumps and stones, unnecessary hedge rows and fences, and ditches. This applies particularly to the South and to some extent also to the Northeastern States. The most practicable method of rearranging fields to secure suitable tillage units from the standpoint of machinery is a subject of research in the bureau.

OFFICE OF THE SOLICITOR



OFFICE OF THE SOLICITOR

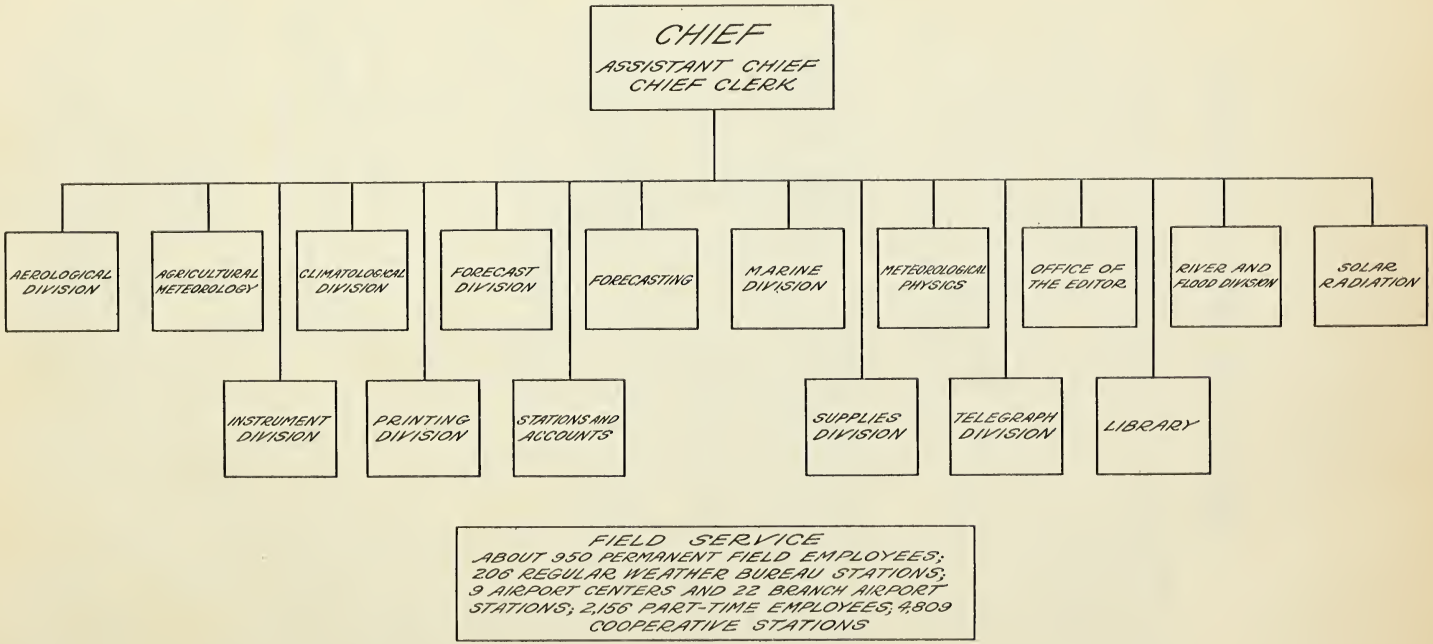
In the administration of the numerous laws enacted by Congress, and the regulations promulgated thereunder relating to agriculture and allied subjects, legal questions and controversies of many kinds must necessarily be considered. By direction of Congress, the legal work of the department is performed under the supervision and direction of the Solicitor, who acts as legal adviser to the Secretary and to the various administrative officers. The Solicitor is assisted by a corps of attorneys. The Office of the Solicitor has divisions which specialize in certain activities of the department. In this manner the office seeks to be in a position to give expert advice on any legal question which may arise.

The office drafts proposed legislation and prepares legal papers of various kinds. It interprets laws enacted by Congress and aids in the preparation of numerous regulations required for the effective administration of laws relating to the activities of the department.

The Department of Agriculture, in the name of the United States, is party each year in thousands of legal controversies involving court procedure. Some of these involve the enforcement of civil rights or the redress of civil wrongs, in which respects the United States is comparable to individuals generally, while others are prosecutions for the violation of criminal statutes. Evidences of wrongs committed, obtained by representatives of the department stationed over the country, are submitted to the Solicitor, who takes such action for the protection of the interests of the United States as the facts justify. This involves a painstaking consideration of each matter presented and a determination of the facts as accurately as possible and the application of pertinent laws to these facts. When such action is warranted, a case is submitted to the Attorney General of the United States, with the recommendation that appropriate legal steps be taken. Aid is extended to the Department of Justice and to the various United States attorneys in the preparation and prosecution of the cases.

Since the interests of the department are very widespread, law officers under the supervision of the Solicitor are located at convenient points throughout the country in order that they may be in personal contact with representatives of the department who may need their aid. Title attorneys also are located in various parts of the country to facilitate the acquisition of large areas of land utilized in the conservation policies of the United States.

WEATHER BUREAU



WEATHER BUREAU

The Weather Bureau came into being as a branch of the Signal Service of the War Department during 1870, under the provisions of a joint resolution of Congress approved February 9, 1870. This resolution authorized the Secretary of War to take meteorological observations at military stations throughout the United States and its territories and to give notice by telegraph and marine signals of the approach and force of storms. This service was primarily for the benefit of navigation on the seacoast and the Great Lakes, but under a provision of the appropriation act approved June 10, 1872, it was extended so as to include the interior districts and the great rivers of the central valleys.

The benefits of the weather service were soon recognized by business industries and the general public, and its enlargement to include agriculture and commerce became necessary. This led to the conclusion that as a scientific bureau it could function better under civilian than under military control. Accordingly, on July 1, 1891, the Signal Service of the War Department was relieved of its meteorological duties, and the Weather Bureau of the Department of Agriculture was organized.

DUTIES OF THE BUREAU

In the act of Congress transferring the meteorological work of the Signal Office to the Weather Bureau of the Department of Agriculture, approved October 1, 1890, the duties of the service are thus summarized:

> The Chief of the Weather Bureau, under the direction of the Secretary of Agriculture, shall have charge of forecasting the weather; the issue of storm warnings; the display of weather and flood signals for the benefit of agriculture, commerce, and navigation; the gaging and reporting of rivers; the maintenance and operation of seacoast telegraph lines and the collection and transmission of marine intelligence for the benefit of commerce and navigation; the reporting of temperature and rainfall conditions for the cotton interests; the display of frost, cold-wave, and other signals; the distribution of meteorological information in the interest of agriculture and commerce; and the taking of such meteorological observations as may be necessary to establish and record the climatic conditions of the United States, as are essential for the proper execution of the foregoing duties.

The major activities of the bureau are the collection and dissemination of meteorological data over the land and sea and the issue and distribution of meteorological forecasts, warnings, and advices. They are administered by project leaders stationed at Washington, D. C., through the agency of a large field organization embracing

more than 200 permanent field headquarters located in every State of the Union, and elsewhere, and several thousand minor and cooperative stations with similar widespread geographical distribution.

METEOROLOGICAL WORK IS PRIMARY

Meteorological observations and reports are a fundamental activity upon which all other projects of the bureau, however specialized, are dependent to some extent. Regular observations, instrumental and visual, of the several elements of meteorological conditions, such as barometric pressure, temperature, rainfall, wind direction and velocity, and cloudiness, are taken regularly at all stations twice daily at 8 a. m. and 8 p. m., eastern standard time. After being coded and forwarded by telegraph to New York and Chicago by means of a special system, the data are redistributed to stations as required throughout the country, all in less than 45 minutes. When special conditions warrant, observations at other times may be taken and forwarded to a designated center from selected points. The meteorological information contained in the observations is disseminated both locally at points of origin and elsewhere as required to meet public needs.

General forecasts and warnings are based on meteorological data secured from observations tabulated twice daily by expert chartmen, and arranged for study and interpretation by experienced forecasters at district forecast centers located at Washington, D. C., Chicago, Ill., New Orleans, La., Denver, Colo., and San Francisco, Calif. Forecasts and warnings of general surface and upper air weather conditions, and of frost, cold waves, storms, and hurricanes, are issued by districts for the entire United States. Local and specialized forecasts are made at both district centers and local forecast stations, to serve nearly all lines of agricultural and commercial enterprises. Daily meteorological values are interpreted by qualified climatologists in monthly and annual bulletins and in occasional special compilations.

CLIMATOLOGICAL SERVICE

The demand for a detailed knowledge of the climate of the United States and insular possessions led to the gradual development of an important and interesting feature of the bureau's activities—the climatological service. In establishing a record of the climate, the bureau uses its great body of observational data collected by thousands of cooperative observers as well as its regular field personnel. These data are summarized and interpreted by qualified climatologists and comprehend a complete climatology of the country in the form of monthly and annual bulletins.

Special weather services are maintained during the growing season of the principal crops. Observations are made each morning at some 400 places in the grain and cotton areas. These are collected

by telegraph, and released within three hours. A weekly service also is maintained for each State and for the country as a whole. Bulletins summarize the weather for the week, and its effect on crop growth and farming operations. Special weekly bulletins report weather conditions over the western grazing areas.

METHODS IN FLOOD SERVICE AND MARINE AIDS

River and flood service provides, by means of river-gage readings at selected points, an authoritative record of daily river stages on the principal rivers of the country. Reports from hundreds of rainfall stations in the important river-drainage basins give precipitation data which, in conjunction with river-stage observations, enable the issue of river stage and flood forecasts by the 65 river-district centers. Mountain-snowfall measurements in the West are a part of this work. On these measurements are based estimates of the quantity of water available for irrigation, hydroelectric-power production, and municipal water supply.

In marine meteorology the Weather Bureau collects observations from ships at sea to determine weather conditions over the oceans. Observations are made by masters and officers of the world's merchant marine without other compensation than the receipt of pilot charts and other free publications. The data are charted, compiled, and studied in the interest of navigation and meteorology and form the basis of the meteorological information given in the pilot charts issued by the Hydrographic Office of the Navy Department, in cooperation with the Weather Bureau, under provisions of an act of Congress approved June 16, 1910.

Extensive service is rendered by the Weather Bureau in the aid of navigation. Storm warnings, flags by day and lanterns by night, are displayed from steel towers located at every harbor of any considerable importance along the Atlantic, Pacific, and Gulf coasts, and on the shores of the Great Lakes. Bulletins for the benefit of ships at sea, containing weather information and forecasts, are disseminated, principally by radio, regularly twice a day and more frequently when severe storms are in progress. These bulletins contain reports of actual weather conditions on land and ocean areas, the location of storm centers, their intensity, and forecasts of direction of movement and speed. The forecasts and warnings pertaining to storms at sea are predicated on observations received by radio twice daily from ships.

BUREAU AIDS IN FOREST-FIRE PREVENTION

To help in preventing forest fires, specialists are employed in the heavily forested areas of the far Western States, the upper lake region, and New England. Surveys determine topography, elevation, ground covering, and other factors as they affect wind direction and force and atmospheric humidity. These surveys, with cur-

rent local weather data, furnish a basis for intensive localized forecasts and warnings as to the fire hazard.

Solar radiation is studied by the Weather Bureau. This work involves measurements of the intensity of the radiation, or heat energy, received at the surface of the earth directly from the sun and diffusely from the sky; the construction and standardization of apparatus for such measurements; studies of the depletion of solar radiation by the gases, including water vapor, and the dust of the atmosphere; finally, the expenditure of the radiation that reaches the surface of the earth, including its effect upon air temperature.

HORTICULTURAL PROTECTION

In fruit-frost service specialists cooperate with fruit growers in protecting their orchards. The work consists of making temperature surveys to determine the relative susceptibility of different localities to frost, the issuing of forecasts and warnings, experiments to determine the most effective and economical methods of protection, and the giving of advice to growers and prospective growers as to favorable locations for orchards and as to heating requirements to prevent frost damage. The specialists study the thermal relations of different localities of their districts and make each day, during the danger period, a very definite forecast of the lowest temperature expected during the ensuing night. Fruit growers are notified through a special system of communication. This service has heretofore been conducted principally in the far West, and it has been started in the east Gulf section. Harvest-weather service is conducted for the benefit of farmers in the harvesting of hay, wheat, and other crops. The work is done intensively in New York State, and to a less degree in Indiana, Michigan, New Jersey, Ohio, Oregon, Pennsylvania, and Wisconsin. Forecasts are issued for guidance in harvesting of crops liable to damage or loss if unfavorable weather occurs between the time of cutting and shocking. The predictions are worded to apply to the particular purpose of harvesting. This work is conducted in cooperation with State extension and county farm bureau agents.

A special fruit-spraying service is given in several important fruit-growing districts as a guide in the application of sprays to trees. The efficiency of sprays, both as insecticides and fungicides, is largely determined by their being applied under proper weather conditions. Orchardists, therefore, need information as to coming weather conditions. The project is intensively organized and conducted in New York State and to a lesser degree in other important apple-growing States. A similar service is conducted as an aid to farmers during harvesting operations.

NATION-WIDE SERVICE FOR AVIATION

Observations of upper-air conditions are made by means of kites, pilot balloons, and sounding balloons. Daily kite flights are made as regularly as possible, at five special stations located in Indiana,

North Dakota, Oklahoma, Texas, and South Carolina. The kites used generally reach a height of 2 miles and carry small self-recording instruments showing atmospheric pressure, temperature, humidity, and wind velocity and direction at all heights reached. Pilot balloons are released at numerous substations and observed by means of a theodolite, or modified form of transit. The balloons ascend at a constant known rate, and the readings secured by the theodolite observer permit the determination of wind direction and velocity at various heights. Sounding balloons are similar but larger than pilot balloons and carry light instruments. They ascend to heights not otherwise reached, in a few cases exceeding 18 miles. The data secured by the methods above outlined are being used in the preparation of a series of monographs under the general title "An Aerological Survey of the United States." Two parts of this survey have thus far been issued.

The rapid development of flying activities in the past few years has necessitated the organization of a specialized service to take care of this need. Provision for the service is contained in section 5 (e) of the air commerce act passed May 20, 1926, which is summarized as follows:

> The Chief of the Weather Bureau under the direction of the Secretary of Agriculture is to (a) furnish such weather reports, warnings, and advices as may be required to promote the safety and efficiency of air navigation in the United States and above the high seas, particularly in civil airways designated by the Secretary of Commerce under authority of law as routes suitable for air commerce, and (b) to observe, measure, and investigate atmospheric phenomena and establish meteorological offices and stations.

As provided by this authority, a detailed network of reporting stations has been organized and is now in operation along the principal Federal air trade routes. Reports of weather conditions are transmitted hourly to central stations of the bureau at important terminal airports, and there used by trained meteorologists as the basis for summarized statements and short-period forecasts which are broadcast by Department of Commerce radio stations, thus being made available to aircraft in flight as well as to interested persons on the ground. This service is supplemented by the longer-period forecasts, issued from the bureau's five district forecast centers, which give the expected changes in conditions for comparatively large areas during the following 12 to 24 hours and which are therefore expressed in general terms.

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The UNITED STATES DEPARTMENT of AGRICULTURE

Its Growth, Structure and Functions

BY

M. S. EISENHOWER, Director
AND
A. P. CHEW, Assistant to the Director
Office of Information

WITH THE ASSISTANCE OF OFFICIALS
IN ALL THE BUREAUS AND OFFICES
OF THE DEPARTMENT

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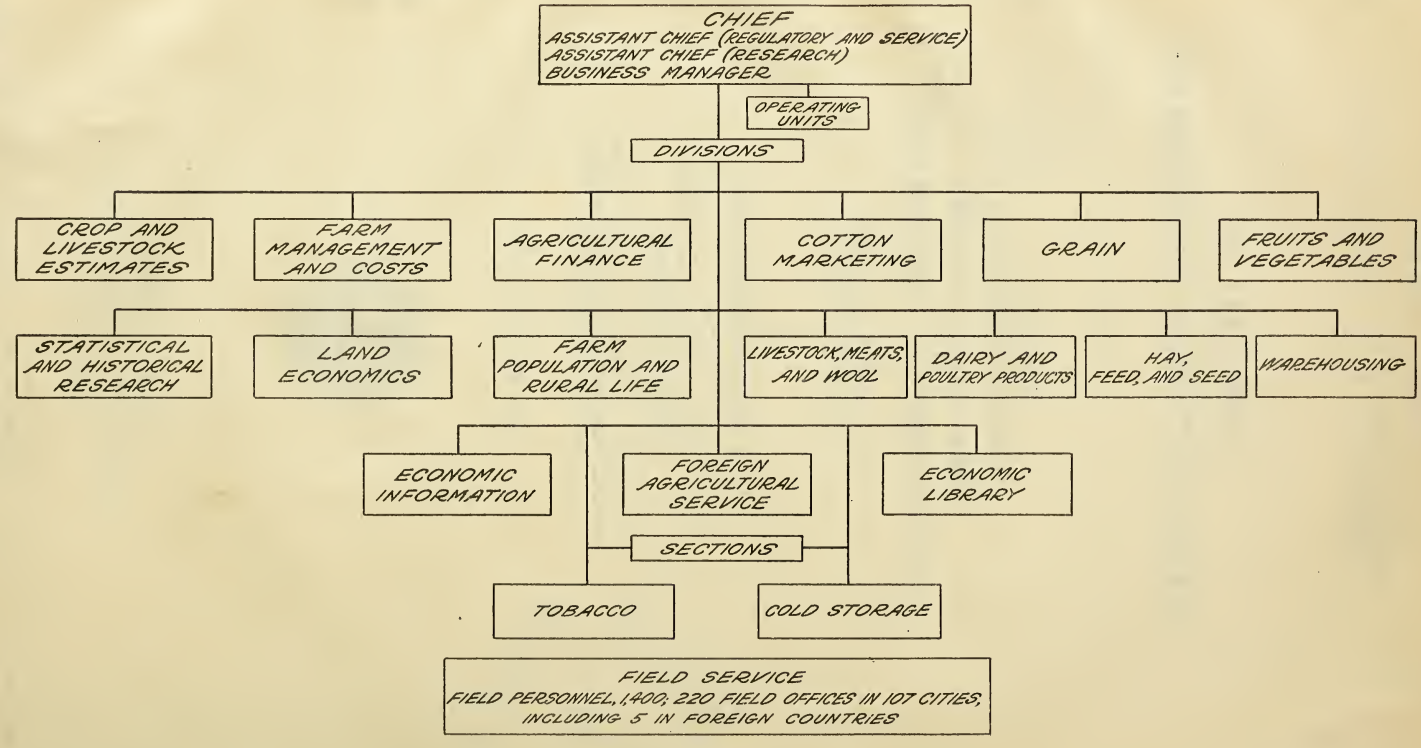
BUREAU OF AGRICULTURAL ECONOMICS



BUREAU OF AGRICULTURAL ECONOMICS

The Bureau of Agricultural Economics is concerned primarily with the economics of farm production and marketing, and with economic policies—land utilization, credit, taxation, etc.—that affect agriculture and farm living conditions. Success in agriculture depends not only on production but also on organization of the farm enterprise in such a manner that maximum net returns may be obtained, and on many other economic questions. The handling and distribution of farm products, as well as production itself, must be efficient. Hence, aside from the strictly technological problems of agricultural engineering and of crop and livestock production, the Bureau of Agricultural Economics deals with all the varied aspects of the problem of making agriculture profitable, and farm life a satisfactory mode of living.

The bureau deals with agricultural problems largely from a broad, national viewpoint. Agriculture should be the source of ample supplies of food and raw materials available at prices that are reasonable to the consumer and yet adequate to provide the basis for a satisfactory farm life. At the same time a proper balance should be maintained between agriculture and other phases of our national life. The primary aim of the bureau is to help bring about these conditions. To this end it concerns itself with the continual changes and shifts in economic conditions that affect agriculture, and studies how farmers may adjust their various activities so as to maintain satisfactory supply and demand relationships.

In short, the bureau is a fact-finding and fact-interpreting institution. In production studies, it deals with the relation of supply to market requirements, with the quality of products that the markets chiefly require, and with methods of increasing the efficiency of farm production. Maximum net profits in agriculture result only when there is a complete coordination of the physical with the economic phases of production. Accordingly, the bureau emphasizes equally the technical economic problems of production on individual farms and the broader problems involved in adjusting production to demand and in advantageously handling and distributing farm products.

PRACTICAL NEEDS SHAPE POLICY

Sociological aspects of agriculture form another concern of the bureau. Conditions of living on the farm and in the farm community are studied with a view to determining facts and indicating possibilities of improvement. To obtain more money for farm families or a larger comparative return, while in itself important, is only part of the problem. The other parts relate to the best use of these increased returns to bring a satisfactory life to the farm family and the farm community. There are many farming areas to-day in which the schools, churches, health facilities, and recreation facilities are so deficient that increasing the income of the individual farmer would not, in itself, provide a satisfactory life for his family in the area in which the farm is located.

The practical, everyday needs of farmers and of agriculture in general are paramount in shaping the bureau's research and service activities, and in its administration of regulatory legislation. Agriculture probably is the world's most competitive industry, and the competition is not merely local and national but world-wide. Moreover, agriculture is subject to hazards of climate and pests over which the farmer has little control. It is, therefore, essential that farmers should be helped as far as possible to anticipate future conditions.

The collection of statistics of agricultural production and the estimating of acreages planted and prospective yields have been important activities of the department since its inception. Knowledge of supplies available and supplies to come is necessary to the plans of both farmers and business men. Elaborate systems of checks and balances have been developed to insure unbiased reports. Practically every farm commodity is covered, and the findings are eagerly awaited and immediately used by the largest exchanges and business houses of the country, as well as by farmers and farm leaders throughout the Nation.

The estimates of crop production and numbers of livestock are not based on judgment figures or opinions, but on returns from more than 300,000 individual farmers, each farmer reporting for his own farm. These estimates are not enumerations. They are systematic attempts, based on samples or other evidence, to estimate the probable outturn of the crops. The aim is to show the probable production as indicated by evidence available as of the date for which the report is issued. Subsequent changes in conditions are taken into account in later reports. The crop-reporting service is generally considered the most adequate and accurate reporting service of its kind in the world. It is furnishing to the grower, to the distributor, and to the consumer invaluable information to replace the wild guesses that were formerly issued from the most varied and often biased sources.

Facts and figures must be analyzed and interpreted if they are to aid producers in planning their production and marketing. Since

1923, the bureau has issued an annual outlook report, a review of the prospective conditions of supply and demand affecting 40 or more important crops. This is supplemented by similar reports, more restricted in scope, issued throughout the year. Significant tendencies in farm production are analyzed, and an attempt is made to indicate the probable trend of supply and demand during the forthcoming year and even for a longer period. During the last three or four years the outlook reports have proved to be about 90 per cent correct.

STANDARDIZATION AND INSPECTION

Commodity standardization and inspection are among the bureau's principal functions, although the establishment and use of uniform standards of quality for farm products is a comparatively recent development. Little had been accomplished in a national way in this field prior to 1913, but since that time much progress has been made. The development of national standards for farm products is essentially a process of evolution, for established trade practices yield slowly to the forces making for change and improvement. In large-scale marketing, however, such standardization is now universally recognized as a basic requirement. Whether or not the producer or the distributor is rewarded for the expense involved in making the necessary classification depends largely on his subsequent marketing practices. The standardization and inspection of farm products, when associated with a wise marketing policy in general, effect substantial savings.

The chief advantages of standardization are: (1) The establishment of a common language between buyers and sellers and other interested parties, and (2) actual separation of products into different grades of market quality. As a basis for trading, a common trade language is indispensable, particularly in the case of commodities like cotton and grain, which are handled very largely in futures contracts. In the case of many commodities not dealt with so extensively in futures, a large amount of business is still done on vague descriptions. This loose method gives rise to frequent disputes. One of the most conspicuous advantages of standardization is its power to prevent trade disputes. When differences arise unavoidably, standardization facilitates the settlement of claims.

Equally important advantages result from the separation of the product into different qualities. For instance, it enables cooperative-marketing associations to pool the products of individual growers, so that lots of different qualities may be assembled in commercially significant quantities. By this means it becomes possible to reflect quality differences in the prices paid to growers. Another advantage is that trading on a quality basis is a great stimulus to better methods of production. In fact, high-quality production can not be expected of the farmer unless he is paid according to quality. Where no standards are recognized, the tendency of the

markets is to pay a flat price based on the average value of the commodities received, a practice that penalizes the producer of superior goods.

Standardization work in the Bureau of Agricultural Economics has two forms: (1) The formulation and mandatory use of standards required by law, and (2) the optional use of standards formulated and recommended after a study of trade requirements. Official standards for cotton, for example, are required under the United States cotton standards act, and must be used in the marketing of cotton in interstate commerce. Under the terms of the United States cotton futures act, all cotton tendered in the settlement of cotton futures contracts must be classed and certified by the bureau through its boards of cotton examiners at delivery points. In like manner, official standards are maintained, and their use is required by law in the merchandising of the principal grains in interstate commerce, when such merchandising is done on a basis of grades. Under the United States grain standards act, all grain sold or shipped or offered for sale or shipment in interstate commerce on the basis of grades must be inspected and certificated according to official standards. Initial inspections are made by licensed inspectors, and the bureau maintains a force of skilled inspectors to supervise the licensed inspectors and to handle appeals from their decisions. Thus, standardization work in cotton and grain has legal force.

Permissive standards for most field products and also for the principal classes of livestock and meats have been developed by the bureau within the last 15 years. Use of these standards, although optional, is increasing steadily, and, in the case of some products, forms the basis for most of their wholesale distribution.

Voluntary inspection and grading service has developed extensively along with the development of the permissive standards. Trained inspectors, at the request of financially interested persons, determine the grade and quality of products offered for inspection and issue certificates as to their findings. In trade disputes, these certificates are prima facie evidence in all courts in the United States, and afford a basis for settlement in terms of definite commodity standards. Approximately 230,000 cars of fruits and vegetables and 31,000,000 pounds of alfalfa hay have been inspected during a single fiscal year, as well as large quantities of many other commodities.

MARKET NEWS SERVICE

Side by side with its standardization and inspection work, the bureau has developed a nation-wide market news service covering all important farm products. This service has become an indispensable factor in the American system of marketing. Reliable information is assembled and made available in time to be used as a basis for action with respect to many problems of production and

marketing. Data and interpretative statements are made available on commodity shipments, market receipts, stocks in storage, imports and exports, prices, the quality and condition of market offerings, and prospective trends of demand and supply. This information facilitates and equalizes distribution, discourages the dissemination of fictitious and misleading market information by unscrupulous persons, places the producer and his marketing organization on a more advantageous basis for bargaining with the usually well-informed buyer, promotes standardization by emphasizing market preferences, aids economic research looking to improvements in marketing methods, and provides information for adjusting production to demand.

The basic information is collected in numerous ways—by trained market reporters who interview buyers and sellers in the markets during trading hours, by telegraphic reports from the railroads on shipments to and arrivals in the important markets, by warehousemen who report stocks in storage, and by numerous contacts with other sources. It is distributed in time for practical use, and every effort is made to improve its timeliness. The bureau operates one of the most extensive leased-wire services in the country. The information is disseminated by market flashes sent over 10,000 miles of leased telegraph lines, by frequent broadcasts over more than 100 radio stations, by the commercial news-dispatch service of the telegraph companies, and by mimeographed reports sent out daily to extensive mailing lists. Thus a picture of the market situation for each of the principal farm commodities, particularly perishables, is kept almost hourly before the interested public.

Such blanketing of the entire country with timely market information pertaining to farm products has decreased the disadvantage of the individual producer and the small shipper who are in competition with the stronger commercial organizations better capable of obtaining for themselves accurate information through far-flung trade connections. The market-news service helps to promote orderly marketing. It has greatly reduced the losses previously sustained through the blind shipment of perishables to glutted markets while other markets were undersupplied. The Federal Government is the only agency in a position to furnish such a service impartially to all concerned on commodities in which there is a nation-wide interest.

ORGANIZATION OF THE BUREAU

The bureau was created in 1921 by consolidating the economic work formerly done in the Bureau of Markets, the Bureau of Crop Estimates, and the Office of Farm Management. Since that time the work has expanded greatly, and the bureau is now organized along two lines—commodity and functional. The commodity divisions are: Cotton Marketing; Dairy and Poultry Products; Fruits and Vegetables; Grain; Hay, Feed, and Seed; and Livestock, Meats, and

Wool. The functional divisions are: Agricultural Finance; Crop and Livestock Estimates; Farm Management and Costs; Farm Population and Rural Life; Foreign Agricultural Service; Land Economics; Statistical and Historical Research; and Warehousing. Each commodity division of the bureau, in addition to its permanent service and regulatory work, conducts research on many problems specifically pertaining to the commodity. Extensive research is conducted by the functional divisions in such fields as farm management, cost of production, credit, insurance, taxation, transportation, land utilization, land tenure and land values, price analysis, foreign competition and demand, and rural life. The bureau maintains an economic library, separate from the department library, and a division of economic information devoted to the publication and dissemination of information.

The bureau has a staff of more than 2,400 employees. More than 250 offices of the several divisions are maintained in various parts of the country. Foreign service representatives are stationed in Europe and in the Orient. Many of the activities of the bureau are conducted under cooperative agreements with State departments of agriculture and markets, agricultural colleges, and State experiment stations.

RESEARCH UNDERLIES MANY ACTIVITIES

As the organization of the individual farm is fundamental to satisfactory returns in farming, the bureau devotes a great deal of attention to farm-management research. This includes not only comparative studies of various farm enterprises in the organization of individual farms as a business, but also cost-of-production studies to disclose weak points in farm practice and to aid in determining those practices that promise the best results. Moreover, attention is given to types of farming and to farm-management problems involved in adjusting output to demand, and in the shifting of regional competition. The present tendency in the bureau is to organize farm-management research on a regional basis and to work more and more in cooperation with commodity specialists and State and local agencies.

Transportation research often follows special problems in response to requests of farmers' organizations and other agricultural agencies. These problems include, for example, the effect of changes in freight rates on production and farm prices, regional competition in farming, and local costs of equipment and other things bought by farmers.

History provides a valuable aid to the agricultural student and research worker and to others who may be called upon to aid in planning public policy in agriculture. Therefore studies in agricultural history are included in the bureau's program.

FOREIGN WORK IS EXPANDING

Foreign work in agricultural economics becomes daily more important. The foreign competition encountered by American farm products must be measured, analyzed, and watched, for this competition is subject to shifts and changes. The bureau's research projects in foreign countries deal with significant developments of farm production and farm technic; with current statistics of production, sale, and export; with trends and prospects. Hand in hand with these projects are those that deal with foreign demand for American farm products. This demand is studied in the same general way as is foreign competition.

The World War brought about many vital changes in supply and demand conditions in European countries, all of which must be charted in so far as they relate to the marketing of American farm products. The possibilities of the full resumption of wheat production in Russia are of vital importance to American wheat farmers, who must be kept informed of developments in this direction from year to year. Beef from Australia and New Zealand is becoming a factor for the American livestock industry to reckon with, as the Argentine industry has been for several years. These are only a few of many instances. To-day civilized countries are so interdependent that American farmers must take cognizance of competition with their wheat, their cotton, their beef products, or their fruits, whether the competition comes from farmers within the United States or from those in Canada, Egypt, Argentina, or elsewhere. Results of these foreign-research projects are now to be made of more vital use to American farmers through the expansion of the foreign agricultural service that has heretofore been conducted by the bureau in a rather limited way.

LAND PROBLEMS FUNDAMENTAL

Utilization of our land resources is one of the most important subjects studied by the bureau. Land-utilization studies yield significant and valuable results to the general public. They point the way toward better State, regional, and national land policies. Such studies involve a cataloguing of all land resources, together with the uses to which each area is adapted; a determination of the present and future need for the products of each kind of land as related to population increase, increased efficiency in farm production, and similar factors; and the outlining of policies that will tend to bring about desirable adjustments in the use of land. Methods used in selling land and in promoting settlement in particular areas are studied with a view to preventing disappointment and loss to the State and to the settlers; to developing the most efficient and economic methods of land use; to directing rational agricultural expansion whenever the desirability of such expansion may be indicated.

Some of the specific studies, now practically completed, that are yielding results of great value are: An extensive study of the methods of land settlement in the Great Lakes States; a study dealing in a broad way with the economic results of our reclamation policies; and a comprehensive survey of the machinery and methods employed by the several States in the encouragement and regulation of land settlement.

Closely related to these lines of research are studies of land tenure and farm real estate. The bureau is obtaining a more complete knowledge of how the farm land of the United States is owned and of the relation of such ownership to the welfare of all groups and of the Nation. The farm real estate situation is surveyed annually to determine the volume of voluntary and of forced sales, the number of foreclosures, the changes in farm-land values, and the influence of the several factors that affect these values. Effort is being made to measure the forces that determine value as a basis for better methods of appraising land for sale, taxation, or credit. All this work looks toward the gradual formation of a conscious national land policy.

CHANGES IN FARM POPULATION

The currents of movement to and from farms are now looked upon by many leading economists as constituting an excellent index of the state of the economic health of agriculture. Farm owners are often slow to shift their occupation under economic pressure, but farm laborers respond quickly. When methods have been worked out whereby accurate current statistics can be secured with regard to the movement to and from the farm, we shall have an index that will respond promptly to changes in agricultural prosperity relative to that of other industries. The bureau is improving its methods of studying these movements, and it may be possible, in the near future, to issue annual or semiannual figures.

Better production at lower costs, improved markets, better prices, and increased income have as a final objective, so far as farm families are concerned, the improvement of the rural standard of living. To facilitate such improvement, studies are being made of the rural population and rural methods of living. These studies include such subjects as migration to and from farms and the causes and results of such migration, farmers' attitudes toward cooperation and other movements believed to be of benefit to them, standards of living among farmers, hours of labor, and farm-family expenditures.

ADMINISTRATION OF LAWS

Regulatory acts of an economic character administered by the bureau include: The cotton futures act, the grain standards act, the

warehouse act, the cotton standards act, the two standard container acts, the produce agency act, the perishable agricultural commodities act, and the tobacco stocks and standards act. As the processes of marketing become increasingly complex, there is an increased demand for certain improvements through legislation. Economic and practical analysis precedes the formulation of the regulations under any act that is entrusted to the bureau for administration, and the current problems that are brought to light, in the course of administration, are given close study in a search for remedies.

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